ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LX. No. 19. CHICAGO, SATURDAY, MAY 11, 1912. ISSUED WEEKLY.

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

Charles W. Price, President and Treasurer.
A. A. Gray, General Manager. H. S. Tuthill, Secretary.
J. B. McCarthy, Asst. Gen. Mgr. C. W. Forbrich, Asst. Treas.

E. E. Wood . . . . . 13 Park Row, New York
Manager Eastern States.
J. B. McCarthy . . . . . Detroit, Mich.
Manager Middle States.
C. W. Forbrich . . . . . Chicago, Ill.
Manager Western States.
European Office . . . . . 42 Old Broad St., London, Eng.
Henry W. Hall, Manager.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

Charles W. Price.....Editor-in-Chief
A. A. Gray.....Managing Editor
Morton Githens Lloyd.....Technical Editor
F. H. Bernhard.....Associate Editor
Howard Ehrlich.....Associate Editor
J. E. Latta.....Associate Editor

SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS 881
Bronze Tablet Commemorating First Telegraphic Train Order Unveiled 884
New York Jovian Lunch.....884
Cosmopolitan Electric Company Forms National Electric Light Association Section 884
Electric Vehicle Association of America Organizes Chicago Section 884
Patent Rights and Public Policies.....884
Electrical Exports for March.....884
Convention of the National Fire Protection Association.....885
Spring Meeting of Mechanical Engineers.....885
Samuel G. McMeen.....885
Jovian Anniversary at New Orleans.....885
Illuminating Engineers to Meet in Philadelphia.....885
W. D. Weaver Retires from Electrical World.....886
Investigations in Electrolysis 886
Electric Power in Brick-Making Plants.....887
Converting the Engineer of the Isolated Plant.....893
Solicitors Must Specialize 893
Brooklyn Electric Rates Reduced.....893
Operating Data of Electric Truck in Davenport.....894
Central-Station Power for Woodworking.....894
Conduit Versus Open Wiring for Places Exposed to Dampness and Corrosive Vapors.—By F. G. Waldenfels.....895
Wiring for Motors in a Speedometer Factory.....989
Temporary Wiring.—By H. G. Wilson.....898
Electric Motor Troubles 898
Meeting of Chicago Members of the National Electrical Contractors' Association 900
M. N. Murphy 900
Among the Contractors 900
DOLLAR WIRING KINKS 901
AMONG THE SUPPLY MEN.....902
The Rules Regulating the Rates for Service.—By Maguire and Mooney 903
PUBLIC SERVICE COMMISSIONS.....905
QUESTIONS AND ANSWERS.....906
The Inspection of Electrical Machinery.....907
Standard Methods Recommended for Testing Dry Cells.... .908
Copper Production Breaks Record..... 910
Detecting the Proximity of Icebergs.....911
Ornamental Lighting for Newport.....912
A Modern Motor-Driven Planing Mill.—By H. Cole Estep.....913
NEW ELECTRICAL AND MECHANICAL APPLIANCES.....915
LATEST APPROVED FITTINGS 920
CURRENT ELECTRICAL NEWS 921
RECORD OF ELECTRICAL PATENTS.....927

Copyright, 1912, by the Electrical Review Publishing Company.

THE TESTING OF DRY CELLS.

From the standpoint of testing, the dry cell has been a much neglected member of the electrical family. It is easy to lay down proper methods for the testing of measuring instruments and the realm of electrical machinery is pretty well covered by the Standardization Rules of the American Institute of Electrical Engineers. Such things as these can be tested at the time of manufacture, so that a good idea can be obtained of what their performance will be in use. With electric lamps, on the other hand, an initial test is not sufficient to entirely determine their value and serviceability, and life tests must be carried out upon selected samples of the output. Similarly, with dry cells it is necessary to carry tests to actual failure or deterioration to the point of discard, before their suitability for any given work can be determined.

The difficulty of prescribing comprehensive tests for dry cells is one which has long been realized. In consequence of this no definite method of testing has heretofore been universally adopted. Efforts have been made to prescribe definite tests, but with only partial success as to their utility. Several efforts to arrive at a comprehensive test which shall be universally serviceable have recently been made, and the results of these efforts have at last been made available to the general user. In our issue of April 20 mention was made of a paper read by Mr. S. W. Melsom before the Faraday Society in England, and in this issue will be found, slightly abridged, the preliminary report of the committee appointed by the American Electrochemical Society. This report was presented at the recent meeting in Boston, at which a paper, also bearing on this subject, was presented by Mr. Carl Hambuechen. An abstract of the latter was given in our issue of April 27.

So far, no one has been able to devise a simple test which shall be generally applicable to determine the serviceability of dry cells for all purposes. Those who have worked over this matter seem to agree that the only suitable test of a cell for a given purpose is to determine its performance under the actual conditions of that service. It is interesting to note, however, from Mr. Melsom's work, that under tests of seven different kinds the relative order of merit of four different makes involved was in nearly every case the same. We must not too hastily conclude, however, that such a statement would be gen-

erally true, as it might not apply to other makes of cell than those which were included in these tests. It does offer some hope, however, that a single method of testing may eventually be found which shall be satisfactory in determining the value of cells for all purposes.

A common every-day test which has been largely used in this country is to determine the short-circuit current which a cell will give. While such a test may disclose the existence of serious defects in a cell, it cannot be taken as either a sufficient or a conclusive test for general application. Makers of cells have met this condition by an output which shows an increased capability in this particular direction without being accompanied by any improvement in durability or watt-hour capacity. The comparison of different cells upon such a basis is consequently likely to be very misleading. Moreover, most persons entirely overlook the fact that the ammeter used will have considerable influence upon the reading obtained, since its resistance forms a very appreciable part of the resistance of the entire circuit. Different ammeters may, consequently, give different results from the same cell. The committee of the American Electrochemical Society recommends that an instrument having a definite resistance, namely 0.01 ohm, shall be used for this purpose. Similar considerations apply to the contact resistance between the leads and the cell terminals and to the resistance of the leads themselves. One important point which has been brought out is that the cells having the highest flash test usually show the greatest falling off with time. This, however, does not indicate a similar deterioration in the capacity of the cell.

The committee of the American Electrochemical Society has done a good service in proposing a definite series of tests which may be applied to determine the value of different cells for the same type of service. It is not intended that these methods be adopted as standard, but they are put forward as suggestions for trial, with the hope that they may induce a wide consideration and discussion of this subject leading to some general agreement for definite and universal tests which may be generally accepted.

SELLING ELECTRICAL ENERGY FOR IRRIGATION SERVICE.

Several weeks ago we published an article which was essentially a review of an unusually successful booklet in which the weak points of the small gasoline and oil engine, and the superiority and economy of electricity for pumping for irrigation purposes were described in nontechnical language. A feature of this pamphlet is the hard-hitting, convincing arguments which have been placed at the disposal of the central-station solicitor for meeting the competition of small prime movers. So many inquiries have been made respecting the origin of this booklet that we take pleasure in announcing that the data and information were compiled by the Southern California Edison Company, Los Angeles, Cal. This company spent a great deal of valuable time and a considerable amount of money in preparing this booklet, but it has more than compensated for this expenditure in direct results within a very short time since its original publication. Such material is invaluable as an aid to the power solicitor, particularly when the textbook data on the subject are scarce.

IMPORTANCE OF DETAILS IN ELECTRIC WIRING.

It has been said that genius is the capacity for taking infinite pains. However this may be, it is certainly true that real skill in electrical construction is largely a matter of familiarity with what to the layman might appear to be trifling details of the work. To install an electric circuit so that lamps or other receiving apparatus may be operated therefrom is usually a very simple matter; but to do really high-class wiring an acquaintance with the work is required which may be had only through careful study and practical experience.

As obviously correct as the above statements may seem to those who have given the matter any thought, there is by no means a general appreciation of the significance of these contentions on the part of the patrons of electric service. There is evidence of this in the very large amount of wiring which is allowed to be done throughout the country by men having very little knowledge of the wireman's craft. It is stated on good authority that one-third of the electrical construction done in the United States every year is done by men not recognized as electrical contractors. A tenth or more of the property wired is said to be wired by the owners themselves. It may be remarked, in passing, that this unfortunate condition is one of the things which warrant the practice, in vogue now in certain localities, of requiring a license of every workman who undertakes to install wiring, and which make systematic inspection of wiring so necessary.

Not only does the public often fail, as just suggested, to appreciate the importance of the electrician knowing just the best way to carry out every detail of a given job of wiring, but it is also true that writers on electrical construction sometimes make a similar mistake. Thus it may happen that subjects are treated in a rather general way and the reader be left to follow the trend of his own opinions in working out details. It appears that in the paper by Mr. Waldenfels which is published in this issue such a mistake has been in an unusually large measure avoided. Even if there were no other reasons, the paper should be interesting and valuable on account of its explicitness in the treatment of the types of construction dealt with.

IMPORTANT TELEPHONE DECISIONS IN WASHINGTON.

The Public Service Commission of Washington has recently handed down two decisions of considerable interest, which involve the connection of telephone systems in that State which have not heretofore co-operated by giving through connections with each other's lines. The substance of the two orders involving similar conditions is given elsewhere in this issue.

In both cases contracts existed between two of the companies, whose traffic provisions stipulated that the third company should not be permitted to make physical connection with the lines of the contracting companies. The Commission has decided that such contracts are opposed to good service and public convenience, and detrimental to the best interests of the subscribers on the lines involved.

The telephone utilities of the State were placed under the jurisdiction of the Commission by an act which was passed by the Legislature in 1907, but this is the first time that the Commission has entered an order involving the principles which have here been applied. The right of appeal to the Superior Court lies in the hands of the companies involved, and it remains to be seen whether they will accede to the orders of the Commission without a legal contest. Since the Commission in its order specifically declines to pass upon the rights of the parties to the contracts involved, it is difficult to see how anything is to be gained by taking matters into court.

Cases often arise where physical connection of different telephone systems is not feasible on account of the conditions of the lines of one of the systems involved. It is, sometimes, not practicable to connect a line which is poorly insulated or used upon a grounded circuit with a long-distance system whose use requires the very best electrical conditions for the proper transmission of speech. In such cases the companies would be entirely justified in opposing any such ruling as that which has here been handed down. Enough is not known regarding the conditions in these cases to venture any opinion as to whether the physical connection is practicable, but if it is, the telephone companies should realize that the time has come when their utilities must be operated in the manner which would give the greatest convenience and service to their patrons and that considerations of the conflicting business interests of particular companies cannot permanently stand in the way of giving the best service to the public. In the present case the existing contracts would have prevented the companies from voluntarily making connections desired by their subscribers, so that it was necessary for the subscribers to make a complaint before the Commission and have an order entered requiring the existing condition to be remedied.

ELECTRICITY IN BRICK MAKING.

Although the art of brick making is of early origin, it appears that only within the past few years have the manufacturers of clay products awakened to the possible advantages to them through the application of electricity to their clay-working operations. The merits and advantages of electric power have now become so apparent, however, that today a large number of brick plants are completely electrified and in no case has the result been unsatisfactory.

The peculiar conditions existing in clay-working plants make electric power especially suitable for the operations involved. Much of the machinery in such plants is widely separated—isolated or located in such manner as to make transmission from line shafts impossible or difficult, resulting in a large amount of lost power. In addition to the driving of machinery, electricity is especially adaptable, in such plants, for the operation of industrial railway systems for the haulage of clay from pit to works, and the operation of electric shovels, digging machines and isolated pumps, fans or other equipment.

The advantages of electric drive are now so generally recognized that the main question to be considered by the manufacturer is whether he can purchase his power at a lower cost than he can generate it in his own plant. Every plant has conditions peculiar to it but in general, from the central-station standpoint, the brick-making industry offers exceptional possibilities for profitable business. It is true that in some localities the condition of the clay makes steam drying necessary and exhaust steam from an engine is utilized, but even in these instances an off-peak rate can make central-station costs comparable with isolated-plant costs, if the manufacturer is properly advised as to both systems.

In plants operating with permanent kilns, the waste heat from which can be utilized for drying, there is no question as to the marked economy of central-station power. One saving, in particular, is in regard to the operation of the blowers and exhaust fans which have to be in service continuously 24 hours a day when there is a charge in the kilns. As the main portion of the plant is operated only during the day time, or approximately 10 hours, it is quite an expense to provide steam power for the engines to drive the blowers and fans the remainder of the 24-hour period. With electric drive, however, this work can be accomplished at a minimum expenditure of energy and cost, as all departments of the plant, with the exception of the kiln department, can be shut down during the greater portion of the time.

Elsewhere in this issue we present an article dealing with the subject of electric power in this industry. As the method of drying is of paramount importance and in many cases dictates the selection of power source, particular attention is called to the results presented on tests of four plants, two employing steam for drying and two hot air.

Bronze Tablet Commemorating First Telegraphic Train Order Unveiled.

At noon on May 2 there was unveiled at Harriman, N. Y., a bronze memorial tablet commemorating the sending in 1851 of the first telegraphic train order by Charles Minot, general superintendent of the Erie Railroad. Special Erie trains from New York City, 47 miles away, brought a large company of distinguished persons. The unveiling ceremonies were simple but impressive. This station was formerly known as Turner, and this memorial is frequently designated as the Turner monument.

The bronze tablet measures 6 feet high by 3 feet 3 inches wide. It was designed by Charles Keck, a pupil of the Sculptor St. Gaudens. The tablet is mounted on a massive carved granite monument presented by Mrs. E. H. Harriman. It was designed by Thomas Ellett, architect, of New York City. One of the largest contributors to the monument fund was Andrew Carnegie, who became a telegraph operator at the age of 14, and who sent the first telegraphic train order on the Pennsylvania Railroad in 1852. The monument was erected under the joint auspices of the Association of Railway Telegraph Superintendents and of the Old Time Telegraphers and Historical Association. The Monument Committee was composed of E. P. Griffith, J. B. Taltavall, Charles Selden, E. A. Chenory, W. J. Camp, Wm. Bender Wilson, F. J. Schurrer and D. H. Bates.

New York Jovian Lunch.

The Jovians of New York City held their customary bi-monthly lunch on Wednesday, May 1. Charles L. Eidlitz, the well known electrical contractor of New York, and one of the founders of the National Electrical Contractors' Association, spoke on the subject, "What Is the Matter with the Business?" Mr. Eidlitz's address was quite to the point, and was illustrated with a number of entertaining and appropriate stories. The chief feature of the discourse was the statement that one of the things that was the matter with business was indifference in regard to credits, and that a good deal more care should be taken in this respect.

Statesman F. E. Watts, who presided, called attention to the next rejuvenation of New York Jovians, to be held May 17, and announced that while a number of new applicants were to be taken in at that time, there was room for many more, and he urged a special effort on the part of those present to make a particularly good showing.

Cosmopolitan Electric Company Forms National Electric Light Association Section.

The Cosmopolitan Electric Company, Chicago, Ill., gave a dinner to its officers and employees on Thursday evening, May 2, to inaugurate its company section of the National Electric Light Association. There were 150 present, and 126 applications for membership were secured. Within two or three days after the initial meeting the membership had been increased to 150. Homer Niesz, general manager of the company, made an address, pointing out the growth and development of the company, and outlining the advantages of affiliation with the National Electric Light Association. The section will hold monthly meetings, a library has been inaugurated at the power house for the use of the employees, and a company baseball team is being organized. The officers of the section are J. H. Delany, chairman; Edward Gilroy, vice-chairman; C. F. Brown, secretary; H. A. Weigle, treasurer, and C. B. Johnson, Ira Hampton, C. Wickman, with the officers, executive committee.

Electric Vehicle Association of America Organizes Chicago Section.

On Tuesday evening, May 7, a dinner was given by the Commonwealth Edison Company at the Hotel Sherman, Chicago, to 105 central-station men, representatives of manufacturers of electric vehicles, storage batteries, controllers and kindred accessories, and representatives of the technical press. The occasion was the inauguration of the Chicago Section of the Electric Vehicle Association of America. A delightful repast was enjoyed, and the material entertainment was supplemented by excellent vocal and orchestral selections. Louis A. Ferguson, vice-president of the Commonwealth Edison Company, presided as toastmaster, introducing W. H. Blood, Jr., president of the Electric Vehicle Association of America, the guest of honor. A constitution and by-laws, based upon the rules of the parent organization, were adopted, and the following officers were elected: Chairman, George Hervey Jones, Commonwealth Edison Company; vice-chairman, Godfrey H. Atkin, Electric Storage Battery Company; secretary-treasurer, J. W. McDowell; executive committee, the officers and C. A. Murphy and L. E. Barr.

A vote of thanks was extended to the Commonwealth Edison Company for their courtesy and generosity in bringing the meeting together. Mr. Ferguson accepted on behalf of the company and thanked those present for their ready response.

Patent Rights and Public Policies.

At the meeting of the Electric Club of Chicago on May 2, C. F. Adams, of New York, delivered a very interesting address on "Patent Rights and Public Policies," pointing out the field for improvement in existing laws. Mr. Adams stated that in granting patents the government should be careful not to deny the natural rights of the people. He suggested that rather than granting a monopoly to an inventor as a reward for his efforts, the government should allow him royalties as this would insure the use of the invention for the public good.

In justification of such changes in patent laws, Mr. Adams stated that hundreds of useful inventions, under present laws, are held for the full term of the patent period without being used, this course usually being taken for business reasons, but nevertheless preventing the public from benefiting thereby.

Mr. Adams stated that according to the constitution, Congress can state the conditions under which a monopoly is granted, which provision would make it comparatively easy to revise the patent laws so that an inventor would be allowed a monopoly so long as his invention was being used for the public good.

Electrical Exports for March.

The Bureau of Statistics of the Department of Commerce and Labor, Washington, D. C., has compiled its monthly summary of the imports and exports of the United States for March, 1912. From these data the following facts relative to the electrical exports have been obtained.

The figures for March show a decided improvement for each class of electrical exports compared with the preceding month and with the corresponding month a year ago. This is shown by the following comparative monthly summary:

Month	Electrical Appliances	Electrical Machinery	Total
March, 1912	$1,081,895	$751,785	$1,833,680
March, 1911	915,601	639,338	1,554,939
Feb., 1912	968,626	672,676	1,641,302

A list of the principal countries to which electrical shipments were made in March and the value of these exports is given below.

Countries	Electrical Appliances	Electrical Machinery
United Kingdom	$ 55,263	$ 51,164
Canada	357,800	184,344
Mexico	124,796	93,786
Cuba	74,067	33,215
Brazil	179,739	35,848
Japan	44,161	143,949

Wireless Train Signaling.

The Pennsylvania Railroad Company is testing wireless telegraphy in the signaling of trains on the main line between Philadelphia and Harrisburg. Between Altoona and Harrisburg a continuous wireless system is being maintained. A partial test of the system has proved successful.

Convention of the National Fire Protection Association.

The sixteenth annual meeting of the National Fire Protection Association will be held in Chicago, May 14, 15 and 16. The sessions will take place in the auditorium of the new Insurance Exchange Building and will be open to the public.

The president's address and the reports of the officers are to occupy the first morning session. The afternoon of the first day will be given up to public addresses, and the technical reports and discussions will come on the second and third days. A visit of inspection to the Underwriters Laboratories is planned for the last day of the convention.

Spring Meeting of Mechanical Engineers.

The spring meeting of the American Society of Mechanical Engineers will be held at Cleveland, O., May 28 to 31. The tentative program of papers includes the following: "The Present State of Development of Large Steam Turbines," by A. G. Christie; "A Discussion of certain Thermal Properties of Steam," by G. A. Goodenough; "The Reduction in Temperature of Condensing Water Reservoirs Due to Cooling Effect of Air and Evaporation," by W. B. Ruggles; "Results of Tests on the Discharge Capacity of Safety Valves," by E. F. Miller and A. B. Carhart; "A New Analysis of the Cylinder Performance of Reciprocating Engines," by J. Paul Clayton; "Equipment of a Modern Flour Mill on a Gradual Reduction System," by John F. Harrison and W. W. Nichols; "Design and Mechanical Features of the California Gold Dredge," by Robert E. Cranston; "Problems in National Gas Engineering," by Thomas R. Weymouth; "New Process for Chilling Cast Iron," by Thomas D. West; "Strength of Steel Tubes, Pipes and Cylinders Under Internal Fluid Pressure," by Reid T. Stewart; "On the Control of Surges in Water Conduits," by W. F. Durand; "Speed Regulation in Hydroelectric Plants," by William F. Uhl.

Excursions will be made to local manufacturing and power plants. There will be receptions on Tuesday evening and on Thursday evening, and on Wednesday evening a lecture will be given by D. C. Miller, of Case School of Applied Science, on "Sound Waves."

Samuel G. McMeen.

Samuel G. McMeen has been elected president of the Columbus Railway & Light Company, Columbus, O. The Columbus Railway & Light Company operates all the electric traction, lighting and power properties of the Columbus Light, Heat & Power Company, the Columbus Traction Company, and the Columbus Railway Company. Mr. McMeen's new connection is a promotion from the presidency of the Mount Hood Railway & Power Company of Portland, Ore.

Mr. McMeen and Kempster B. Miller opened their offices as consulting engineers in Chicago, April, 1904. For two years before this Mr. McMeen was an engineer with the Western Electric Company in charge of telephone exchanges and equipment. Previous to that for seventeen years, after leaving Purdue University, he was assistant engineer, chief engineer and was located in various capacities in the operating, construction and engineering departments of the Central Union Telephone Company. Nine years of this time was spent in the company's headquarters in Chicago, and eight years in the field in Ohio, Indiana, Illinois and Iowa. Several years ago Mr. McMeen made a complete study of telephone conditions of the city of Mexico, and prepared a complete plan for extensive underground conduit and cable systems. Quite recently he was engaged in engineering a number of large properties on the Pacific Coast, and as a result of his great familiarity with the details of transmission lines and the operation of public-utility corporations, he was elected president of the Mount Hood Railway & Power Company. He will remain a partner in the firm of McMeen & Miller.

Samuel G. McMeen,
President of the Columbus Railway & Light Company.

Jovian Anniversary at New Orleans.

The thirteenth anniversary and rejuvenation of the Sons of Jove was held at Spanish Fort, New Orleans, La., on Saturday evening, May 4. Hugh McCloskey, president of the New Orleans Railway & Light Company provided transportation from the city, donating a special car to convey the party to Spanish Fort, the nearby lake resort now operated by the company and only recently opened to the public. The rejuvenation was under the direction of Mike S. Hart, statesman for Louisiana. The toastmaster was Robley S. Stearnes. The banquet committee was headed by William E. Clement, chairman, assisted by Burton French, Joseph C. Conery, and I. G. Marks. Music was furnished by the Silver Leaf Orchestra, of New Orleans.

Illuminating Engineers to Meet in Philadelphia.

The regular monthly meeting of the Philadelphia Section of the Illuminating Engineering Society will be held at 1000 Chestnut Street on Friday, May 17, at 8:00 p. m. At this meeting the election of the section officers for the year 1912-13 will be held.

The paper of the evening will be delivered by A. J. Rowland on "Essential Principles of Illumination." He will take up the calculation of illumination and principles of photometry. This talk will be illustrated by practical demonstrations and lantern slides. The exhibition will be standards of light and apparatus used in photometric measurements. and illumination calculations.

Preceding the meeting a special dinner will be served at the Bingham Hotel, Eleventh and Market Streets, at 6:00 p. m.

Another Big Rejuvenation of the Sons of Jove at Schenectady.

On the night of April 19, the Schenectady order of the Sons of Jove held a second rejuvenation at Keller's Hotel in Albany, when eighty-three candidates were admitted. It will be remembered that only a few weeks ago the Schenectady organization broke all previous records by initiating a class of 150 members.

This last rejuvenation was the occasion of much merry making. The eighty-three satellites were escorted to the Capitol City by the members in a chartered train where a sumptuous dinner awaited to prepare them for their trip to Jupiter's realm. The unfortunates to wander in the unknown regions, beset by Pluto and his imps, were R. F. Gilmore, Randolph Troy, E. L. Bludgett, George Bliss, G. Kahl, C. W. Gray, H. E. Butler and W. G. Lane. They were escorted by J. C. Dallam, C. N. Gregory, H. B. Lane, H. Kuhn, M. B. Carroll and R. C. Muir.

The degree team, deserving much credit for its excellent work was as follows: Jupiter, W M. Deming; Neptune, F. L. Slater; Vulcan, H. R. Leonard; Mars, R. H. Carlton; Hercules, H. L. Smith; Apollo, F. R. Davis; Mercury, James Burns; Pluto, A. M. Jackson. Imps, E. A. Johnson, J. H. Crawford, W. F. Snead, G. L. Alexander, R. E. Woolley, H. J. Farrell.

W. D. Weaver Retires From Electrical World.

W. D. Weaver, who has been editor of the *Electrical World* since 1893, has retired with the issue of May 4, to devote himself to personal interests. Mr. Weaver has always represented the engineer and scholar of the highest attainment, and he has made an impress upon electrical journalism that is regarded with the highest degree of respect and reverence. To him belongs the credit for a great deal of the best development that has come to the industry. He has been an honored and honorable member of various technical commissions, and his great knowledge of his subject, and his unflinching adherence to the side of the right have given him a power of mastery and leadership that few men have ever possessed. Upon the occasion of his retirement James H. McGraw, president of the McGraw Publishing Company, has paid him a tribute in the columns of the *Electrical World* of May 4, saying among other things: Mr. Weaver's character as a man possesses a peculiar charm born of the combination of many opposing attributes. With a modesty and gentleness so pronounced that it may be called invincible he has a virility of will and an independence of thought that have made much of the artistic temperament and with the imagination to see things invisible to more prosaic minds he combines a rugged common sense that makes him practical and that has kept his feet on solid earth. A man of letters and of science given to abstractions and generalizations, he is never forgetful of the concrete and human side of human relations. A man of the world, a cosmopolitan with an extremely wide range of travel, observation and personal experience, yet he is simple, plain and unostentatious in his habits and mode of life. A man who knows guile, he is always rigorously honest and appreciatively sympathetic. Weaver is a real man, though he may be a little old-fashioned in that he is never boastful and delights in seeing credit given to others for things that he has done."

As a token of the esteem in which he is held, some of his immediate personal friends and the journalistic associates of Mr. Weaver tendered him a luncheon at the Engineers' Club, New York, April 29. Mr. McGraw acted as toastmaster. Among those who expressed their appreciation of the honorable editorial career of Mr. Weaver were his editorial predecessors T. C. Martin, now secretary of the National Electric Light Association; Louis Bell and Carl Hering. Among others present were B. A. Behrend, J. J. Carty, John R. Dunlap, W. C. L. Eglin, Gano Dunn, and A. S. McAllister. In retiring to private life Mr. Weaver will devote himself largely to further literary study, and to the completing of his already extensive library. He will still devote much of his time to electrical matters, and will act as consulting editor to the *Electrical World*.

Investigations in Electrolysis.

In a report to the Secretary of the Department of Commerce and Labor, the Director of the Bureau of Standards states that during the last fiscal year the number of tests increased to considerably more than double that of the previous annual period.

This growth is attributed to the steadily increasing interest of the industries in applying scientific data and principles to manufacturing. The great demand for investigations and information has taxed the available force to meet it. A noteworthy feature of the year's progress has been in the investigation and testing of structural materials. The completion of extending investigations affecting the fundamental electrical units and standards is also of special interest.

During the past year an extensive investigation into the subject of electrolysis has been in progress. This subject is one of great practical importance, not only to engineering interests but to municipalities and the general public. Damage to water and gas pipes and other underground structures by stray electric currents has long been a source of serious trouble, and although much work has been done by private interests with the view of mitigating the evil, a great deal of investigational work remains to be done before remedial measures can be applied with satisfactory precision. Also during the last few years a great deal of attention has been drawn to the possibility of damage to reinforced concrete structures, due to stray currents, and much alarm has been created in some quarters lest great damage to buildings, bridges, etc., may result from this cause. Although the possibility of damage of this sort had been established, little was known before this investigation was started in regard to the extent of the damage that had occurred, the conditions under which trouble might be expected, or the best method of mitigating the evil.

The present investigation was undertaken in response to requests from important engineering interests, and in carrying out the work the Bureau has had the hearty co-operation of many engineers, corporations, and municipalities, they in some instances incurring considerable expense in order to assist the Bureau in making the investigations. During the first half of the year under consideration the work was confined mainly to investigations relating to electrolysis of reinforced concrete, owing to limitations of equipment and personnel, but early in the present year the work was broadened to include investigations into the general subject of electrolysis, particular attention being given to methods of preventing trouble from this source. A great deal of valuable information has already been obtained, but much important work remains to be done, and it is planned to continue the work

Electrification in Pittsburgh.

The electrification of the Pittsburgh & Lake Erie Railroad between the Pittsburgh terminal and Beaver Falls, Pa., is planned for the near future. This is a four-track road and the traffic is so congested on this 25-mile stretch that electrification is favored for the rapid movement of cars. A frequent surburban service is contemplated in connection with this change.

Business Science Club Organized.

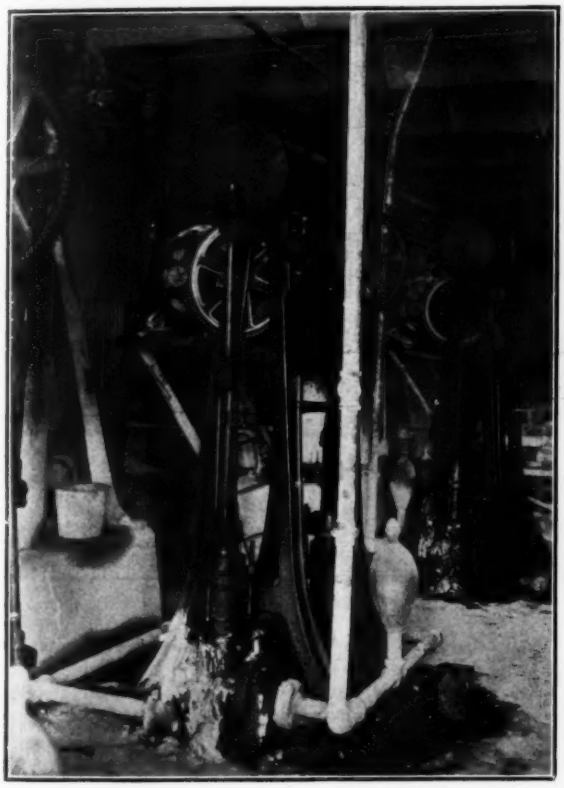
A charter has been applied for by the Business Science Club of Philadelphia. Charles F. Apgar, department manager of the Electric Storage Battery Company, is vice-president of the organization. Other members are Thomas L. Hammersley and W. Y. Kelly, of the Electric Storage Battery Company; W. T. Brown, Jr., and James A. Cummings, electrical contractors.

Electric Power in Brick-Making Plants.

While the art of brick making is of early origin the use of electricity in the industry is comparatively new and many plants have yet to be converted to the more modern method of operation. Data secured from plants using motors are presented in this article, together with comparative data on various methods of drying. The latter, in a large measure, determines the source of power.

It has been within the past 20 years that the introduction of power-driven clay-working machinery has revolutionized the art of brick making and given it its proper rank among the greatest of the world's industries. The present annual production of brick is unknown, but a conservative estimate places the aggregate output of the 100 and more varieties of bricks manufactured in the United States alone, at more than twenty thousand millions per year. This tremendous result has been reached only with the aid of the electric motor.

The developments which have furthered this advance include principally the improvements in the various machines which prepare the clay, improvements in the methods of handling the raw material in its various stages, and the improvements in the drying and burning processes. These are acknowledged facts and are demonstrated conclusively in any modern plant.



Two Views of Motor-Driven Machines in Brick-Making Plants.

The brick and tile industries are quite similar to the steel industry regarding the stage of development, for the future of each depends largely on the economies and refinement of their respective arts.

Clay possesses the characteristic property of "plasticity" by virtue of which, when subjected to a deforming pressure and the pressure removed, it preserves the shape of the mold. The degree of plasticity can be varied by tempering or adding in suitable quantities water and sand, sawdust, ashes or other inert material. The further manipulation then falls under one of four general methods, hand molding, stiff plastic, semi-plastic or dry methods, each of which, with the possible exception of the first, permits of the advantageous application of electric power. The stiff-plastic process is generally recognized as the best and most economical where the nature of the raw clay makes its use possible.

In up-to-date plants equipped for electrical operation throughout, a great variety of motor application is found. The clay or shale is excavated by means of electrically operated shovels and loaded into transfer cars hauled by an electric yard-locomotive, to stock piles where, under action of rain and frost, it is weathered and partially disintegrated. From the stock piles the clays, especially the harder shales, are transferred to the motor-driven roll crushers or dry-pans, and screens, and then by cup conveyors to the pug mill. From the pug mill the now thoroughly mixed and tempered mass is delivered to the auger brick machine where it is forced through dies carefully designed to produce a true cross section with maximum uniformity of density, in the form of a continuous rectangular column. A frame carrying tightly strung piano wires or suitable knives rotating at the proper speed, cuts the issuing column of clay into standard sized blocks or bricks. The green bricks are carried by a belt conveyor, which moves somewhat faster than the column issuing from the auger and consequently separates the bricks slightly, to the represses where they are forced into molds and subjected to heavy pressure. This operation smooths the surface and squares up the corners. The brick is now ready for the drying house and kiln.

In addition to the machines mentioned, electric motors find a most satisfactory application driving centrifugal or geared pumps for removing excess water from the clay pits and also for driving the large ventilating fans in the drying house.

The many advantages and the great resourcefulness of electricity have been important factors in solving these problems and afford: more economical arrangement of plant; increased output; decreased maintenance cost; high efficiency of plant operation and reduction in power costs.

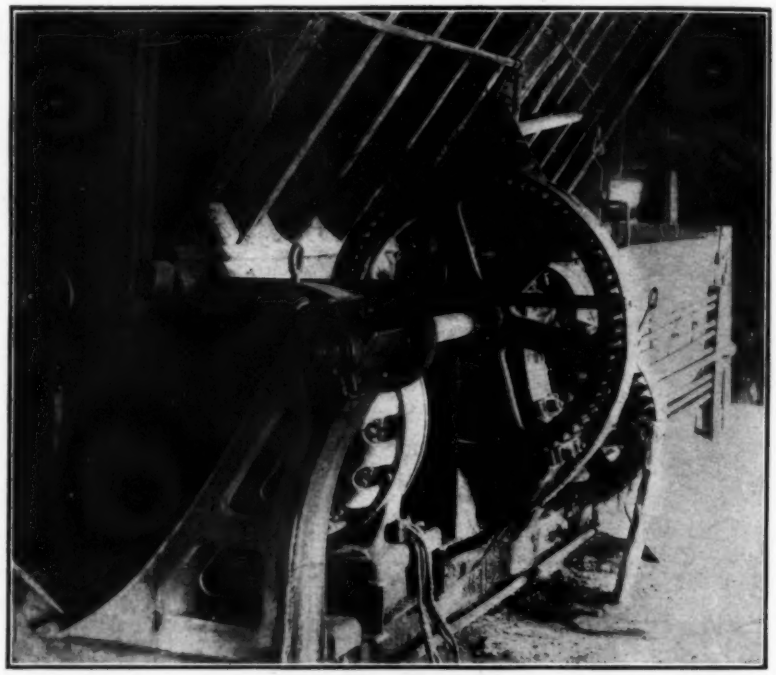
In contemplating the layout of a brick plant the first point for consideration is the location. Railroad facilities, water, coal and the location of the raw material are important factors. The use of electric power when supplied by central stations simplifies the problem as the water and coal questions become of secondary importance. The various departments of the plant can be located and arranged to the best advantage for operating without the limitation of arrangements imposed by central engine drive with belt connections between the various departments.

Where the various machines or departments are operated by individual motors there is greater assurance of continued operation as compared with a central engine drive in which case engine trouble means a shut down of the entire plant. Motors maintain practically a constant speed throughout their operating range which results in an increased production as compared with a plant driven by a single steam engine where the speed varies not only with the boiler pressure but also with the variation in load. The most practical method of drive for auxiliary apparatus such as brick-setting machines, haulage locomotives, and other traveling machinery is by means of electric motors. These machines greatly facilitate the making of brick and tile and provide economical methods for increasing the output of existing plants, and are of even more importance in large plants where the question of handling the produce is a serious problem.

Decreased maintenance cost is insured by the adoption of electric motors. As is well known, motors are of simple construction and even for the most severe classes of service are very durable. Due to the fact that they can be applied at the closest position relative to driven machine, the connecting apparatus such as belts, gears, etc., are reduced to a minimum. As the driving units are of comparatively small size it is an easy matter to make slight changes from time to time to compensate for wear of bearings, etc., thereby preventing undue wear of parts due to poor conditions of machinery. Fuses or circuit-breakers are installed in the motor circuit as a protection against severe overloads such as caused by clogging of the various machines which might cause damage to the motor and the driven apparatus. The possibility of shut downs due to machine breakage is thereby greatly reduced.

By connecting motors at the nearest available point, line shaft and other belt friction is reduced to a minimum. The various motors operate at good efficiency as they are each working practically at their rated load. In the case of central engine drive, a shut down of part of the machinery means a reduced engine load—with a reduction in operating efficiency due to this cause and also due to the fact that the proportional line-shaft friction load has increased.

With motor drive any individual machine or group of machines can be operated independently of the rest of the plant. Overtime in any section entails power charges proportionate only to the machines in actual service. Often, in brick plants the points of application of power are widely separated necessitating makeshift methods or the installation of wasteful and inefficient non-condensing steam engines. Excavating shovels and drainage pumps at the clay pits, ventilating fans in the dry house and the brick machines proper invariably require separate sources of power unless a centralized system of electrical distribution is employed. Where motors are employed, additional motor-driven units can be installed from time to time and the capacity of the plant increased without reference to existing line shafts and belting problems. In many instances, even where the buildings are of heavy construction and an accurate alinement of shafting and hangers is comparatively a simple matter, the transmission losses are from 20 to 40 per cent, or more, of the total horsepower developed. Except in the largest brick plants, the buildings are such as to make an efficient mechanical system of power transmission an impossibility.



Motor-Driven Pug Mill.

Selection of Motors and Power Requirements.

The machinery required and the methods adopted in the manufacture of bricks are governed largely by the nature of the raw material available and the desired character of the finished product. For the most part, a careful selection from the great variety of standard motors built for general industrial service will fully meet the requirements of clay-working machinery. The range of so-called standard motor design is so great, however, that when new installations are contemplated, it is often to the advantage of the customer to take up with the manufacturer the requirements of each proposed application.

In general alternating-current induction motors fully meet the requirements of clay-working machinery. They are of simple construction with large overload capacity and have no wearing parts except the bearings or slip rings, which in every case are of ample design. The particular form of induction motor to use will depend upon the capacity of the distributing system and service characteristics, including such considerations as frequency or starting, starting torque, continuous or intermittent operation, reversal, etc.

For dry pans, sanders, conveyors, fans, bucket elevators and other ma-

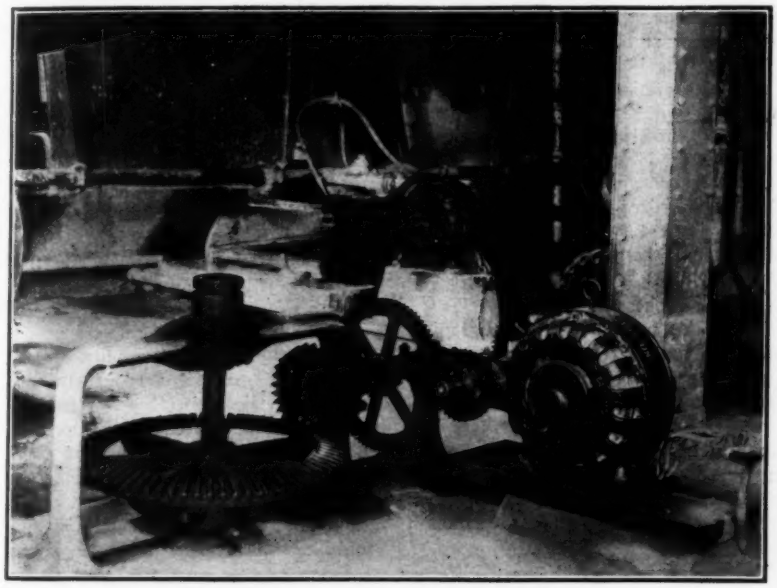
chines with similar requirements the standard induction motor with short-circuited bar-wound rotor is usually entirely satisfactory. Each of these applications involves continuous duty at constant speed together with relatively easy starting conditions and no occasion for reversal of direction of rotation. On the other hand, for pug mills, augers, tempering wheels, hoists, excavating shovels, etc., where frequent starting and reversal, variable-speed requirements and excessive starting torque are encountered, the induction motor with phase-wound rotor and external secondary resistance, is in general recommended. This form of motor with variable secondary resistance is designed to secure maximum torque with the least possible shock to the system when starting under load.

When for any reason direct-current apparatus must be used, motors with compound windings should always be specified, except for driving fans, for which service shunt-wound motors are suitable. Where the service requirements are similar to those outlined for the induction motor with short-circuited bar-wound rotor, the direct-current motor should have the standard amount of series winding; where the induction motor with phase-wound rotor would be suitable for alternating-current service, the direct-current motor should have approximately 40 per cent of series winding and commutator and bearings should be properly protected from grit and flying mud.

If motors are geared or belted direct to any of the large machines without the use of friction clutches they should be designed for a high starting torque since when starting any of these machines full of clay a very large torque is required. Either induction or direct-current motors may be designed to meet these requirements. If friction clutches are used the motors may be started light and the load thrown on later but this introduces another piece of apparatus subject to wear and trouble and should be avoided where possible.

The direct-connected motor drive makes the most compact and efficient layout but care must be taken to see that none of the laws of mechanics are violated; that is, that the foundations are solid, that gears are not run at too high speed, that they are well supported in bearings and rigid, and that the motor is not subjected to severe vibrations. The motors are not injured by the clay and dust, and if the mechanical application is well made a satisfactory drive is assured.

As to the horsepower required to drive the various machines used in the brick-making industry, the following motor sizes are the average taken from several similar installations all of 100,000 bricks capacity per day.



Direct-Connected Motor Applied to Clay-Working Machine.

Machine.	Horsepower.
Electric locomotive	30
Hoist	20
Dry pan	30
Elevator	10
Pug mill	50
No. 65 auger	90
Repress	30
Transfer car	10
Brick-setting crane	25

Additional data are given in the following table.

Machine.	Horsepower.
No. 1 Horizontal clay steamer, 20 by 10-inch	10
Eagle D. M. brick press	5
No. 42 D. M. brick press	5
R. 2 brick repress	5
No. 33 roofing tile press	8 to 15
No. 39 roofing tile press	5
No. 46 roofing tile press	4
American Clay Machinery Company.	
Model.	
B-4 mold press-brick machine	10 to 12
C-4 mold press-brick machine	10 to 12
D-3 mold press-brick machine	10 to 12
D-4 mold press-brick machine	10 to 12
2 and 3 mold press-brick machine	8 to 10

American Clay Machinery Company, Auger Brick Machines.

No. 1 giant	40 to 60
No. 2 giant	25 to 30
No. 6	15 to 20
No. 8	25 to 35
No. 10	30 to 50
No. 15	75 to 100
No. 41	30 to 50
No. 43	35 to 40
Acme	20 to 25
Centennial	20 to 30
Mascot	10 to 12
Special Giant	75 to 100

The following data were obtained from carefully conducted tests on machines in actual operation. It should be distinctly understood, however, that the horsepower required by the several machines mentioned varies widely under different conditions, as will be sufficiently evident from the following figures. Although secured with greatest care for a given set of conditions, in no case should these results be used except for rough estimates of probable requirements.

Standard nine-foot dry pan driven at 170 revolutions per minute by 35-horsepower motor. During test a soft dry shale was fed into the dry pan at an average rate of 9.8 cubic yards per hour. The maximum load recorded was 40 horsepower; the average load, 29.6 horsepower. When moderately full of fine dry shale a starting torque of 1,450 foot-pounds was required. If clay is wet, as in rainy weather, this value may reach 2,000 foot-pounds and the average load may run as high as 50 horsepower. When running empty the dry pan required 12.5 horsepower.

Special double-shaft pug mill driven at 135 revolutions per minute by 25-horsepower motor. This machine is essentially a long trough in which the pulverized clay from the dry pan is mixed with water by means of revolving paddles. The load varies with the consistency and quantity of material handled. The effect of the first factor is small but changes of level in the pug mill due to temporary shut downs of the auger, produce great variations in the power required. With mill nearly empty, six horsepower is needed; with clay up to shaft, 14 horsepower; with mill two-thirds full, 25 horsepower; when even with top of knives, 35 horsepower, and when full, an average of 44 horsepower. When fed at the average rate of 19.5 cubic yards per hour, the average load on the motor was 31.6 horsepower; when empty, five horsepower. The starting torque when the mill is two-thirds full is approximately 2,300 foot-pounds.

Ten-foot pug mill driven at 248 revolutions per minute by 25-horsepower motor. The power required with varying amount of material in the mill ranged from 5.2 to 25 horsepower. When fed at the rate of 5.5 cubic yards per hour, the average load was 12.5 horsepower. With mill full the torque required to start was approximately 300 foot-pounds.

Special giant auger driven at 165 revolutions per minute by 125-horsepower motor. This machine is essentially a power-

ful screw which forces the plastic mass through suitable dies and cuts the issuing clay stream into sections. The load fluctuations are gradual, varying with quantity and consistency of the material from 53 horsepower with the auger nearly empty to 125 horsepower when full. When fed continuously at the rate of 19.5 cubic yards per hour and clay level maintained at the top of the blades, the average load was approximately 100 horsepower. Other test runs show that the power required varies little with changes of speed ranging from 150 to 180 revolutions per minute. The starting torque required varies with the quantity and consistency of the clay and the period of idleness but is somewhat more than 2,000 foot-pounds.

No. 1 giant auger driven by 35-horsepower motor. This machine when fed at the rate of 5.5 cubic yards per hour from the pug mill mentioned above has an average load of 18.5 horsepower. The power required varies with the amount of clay in the auger from 12 to 25 horsepower. The maximum possible load with hopper full of hard clay is about 35 horsepower. The starting torque when the mill is filled to level of shaft is 750 foot-pounds.

Eagle repress driven at 100 revolutions per minute. This machine presses 550 fire bricks per minute, the average load being but 1.8 horsepower.

Belt conveyor. This conveyor consists of a 24-inch belt with 30-foot span running at 150 feet per minute and carrying 19.5 cubic yards of shale per hour. Average load is approximately one horsepower and does not vary appreciably.

Cup elevator driven by five-horsepower motor. This elevator consists of a 10-inch belt moving 470 feet per minute. When raising material to a height of 36 feet at the rate of 19.5 cubic yards per hour, the steady load is 3.6 horsepower.

Drying drum group driven by 40-horsepower motor. This group consists of a belt conveyor which carries the damp clay from a mixer to a drying drum heated by a blast of hot air forced through it by means of two motor-driven fans. A cup elevator carries the dry clay to the bin above. This group is always operated as a unit and requires approximately 40 horsepower when normally loaded.

Dry-press group. This group consists of a belt conveyor which brings the dry clay to the pulverizer where it is ground and emptied into a bin from which it is carried by a cup elevator to the dry press. The conveyor requires about two horsepower when loaded; the pulverizer takes an average load of about 9 horsepower and the cup elevator, 3 horsepower. The dry press running at 130 revolutions per minute and pressing 130 bricks per minute, carries an average load of three horsepower, making the total average load when the diversity factor is taken into consideration about 125 horsepower.

Cost of Electrical Operation.

Accurate figures covering cost of electrical operation are difficult to obtain owing to the widely varying factors influencing production. Records from several New England plants with a daily capacity of from 50,000 to 100,000 soft-mud sand-molded bricks, indicate a fair average of 15 to 20 molds of six bricks each per minute or from 90 to 100 bricks per kilowatt-hour for all electrical power consumed. Plants using the stiff-plastic method show approximately the same output per kilowatt-hour energy expended in brick machines proper. One plant of 156,000 daily capacity shows a power consumption of 1,740 kilowatt-hour per day for its auger brick machines. Another plant, with a daily capacity of 200,000 common bricks, show for two successive months an average monthly output of 4,700,500 bricks at an average expenditure of 45,600 kilowatt-hours in driving its auger machines. Where the change from steam engine or other form of mechanical power has been made, an estimated saving in operating expense of from 20 to 30 per cent has often been effected.

While the total power required, including auxiliary devices, varies from 12 to 18 kilowatt-hours a conservative estimate of power required by pug mills and augers is about 1.5 horsepower per 1,000 bricks per 10 hour day, or 11 kilowatt-hours per 1,000 bricks produced.

Process of Drying.

From the central-station standpoint, the opportunity to sell power to brick manufacturers depends almost entirely on the method of drying employed. In addition to sun drying there are three general methods used, depending to some extent upon the condition of the clay. These three methods are: steam drying, waste heat and direct heat.

	Steam Dryer, Natural Draft.	Steam Dryer Natural Draft.	Hot Air, Forced Draft.	Hot Air, Forced Draft.
Capacity of dryer (bricks)	390,096	395,280	175,560	544,320
Brick dried in 36 hours	373,000	395,000	219,000	362,880
Outside temperature—Fahrenheit	33°	20.5°	35°	34°
Temperature of emergent air—Fahrenheit	121°	154°	104°	128°
Average mean temperature of dryer	106	119.5	88.80	117
Average relative humidity, per cent	29	26	70	67.1
Average grains of moisture per cubic foot	15.5	16.9	14.2	20.6
Volume in cubic feet	78,678	112,028	126,595	537,156
Average moisture taken from brick, ounces	11	12.5	13	.....

If the drying of the brick is to be done by steam, generation of energy at the plant often proves more economical than purchased energy, although several factors other than actual coal consumption must be considered. Numerous plants, however, have found it profitable to purchase power although using steam for drying.

Unquestionably, the most economical and efficient method of drying brick is the hot air system which uses waste heat from the kilns. Motor-driven fans draw the hot-air and gases from the kilns to the dry rooms. Usually an auxiliary furnace is employed with this system. When this method of drying is employed, central-station power will, in every instance, effect a considerable saving. The accompanying table shows the results of tests conducted on four drying plants, two using exhaust steam and two using waste heat. The increased efficiency of the latter is at once apparent.

Regardless of methods of drying, however, another factor which dictates the adoption of central-station power is the temporary nature of most plants. Usually, when the workable supply of clay is exhausted, plants shift their location to more desirable points. If this policy is adhered to it would, of course, be impossible to maintain an isolated plant with any degree of efficiency. Also, the actual cost of foundations, boiler setting, etc., would in many cases equal the cost of purchased power.

Typical Installations.

The Bibb Brick Company of Macon, Georgia, is representative of a large class of moderate sized plants which are finding electrical operation greatly to their advantage. This plant has a capacity of 200,000 common bricks per day and was formerly operated by a 350-horsepower single-cylinder, non-condensing Corliss engine belted to a heavy countershaft.

In determining the proper type and size of motors for driving clay machinery, it must be borne in mind that the power requirements vary greatly with the plasticity of the material used; there are, however, certain general considerations involved in the selection of electrical equipment of this plant, which are common to all. In replacing the steam engine with motor drive, the likelihood of delays due to breaking belts and unavoidable slip involving loss of power, speed, and lessened production, was clearly recognized, consequently, a direct-geared drive was decidedly upon. The Bibb Brick Company has installed two No. 8 Chambers Brothers auger brick machines with a normal capacity of 100,000 bricks each, when driven at 250 revolutions per minute. For each of these machines, the builders recommended a 100 horsepower continuous-duty motor. It was found, however, that the clay pits contained a strata bearing considerable sand and that when using clay from that particular source the augers must be operated at a lower speed, otherwise the

(*Continued on page 893*)

Brick-Plant Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power coresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Enid Vitrified Brick & Tile Company, Enid, Okla. Manufactures brick and tile products. Group drive. Running hours per week, 60.

Total connected horsepower, 60. Number of motors installed, 1. Average kilowatt-hours per month, 8,399. Average kilowatt-hours per month, per connected horsepower, 139.

Kilowatt-hours per month for 12 months: January, 7,870; February, 9,530; March, 13,070; April, 11,850; May, 12,050; June, 10,150; July, 6,010; August, 5,350; September, 4,000; October, 9,500; November, 9,720; December, 1,680.

Load-factor, 25.7 per cent; operating-time load-factor,53.8 per cent.

The average electrical energy consumed per 1,000 bricks made is 11.2 kilowatt-hours.

MOTOR INSTALLATION.

The motor installed in this plant is a 60-cycle, three-phase, 2,080-volt machine.

No.	Horse-power.	Speed R. P. M.	Application.
1	60	720	Belted to a line shaft driving one nine-foot, Frost Manufacturing Company's dry pan; one Chisholm & Boyd mixer; one six-mold brick machine, capacity 30,000 bricks per 10 hours; and one 2,000-pound hoist elevator and conveyors.

This plant has been motor driven for three years without a day's loss due to motor power. Energy is supplied by the Enid Electric & Gas Company.

Keystone Clay Products Company, Greensburg, Pa. This is a six-kiln brick plant with a capacity of 60,000 bricks per day. The average daily output is 28,000 brick. Running hours per week, 60. (The pan and pug mills are operated approximately 48 hours per week.) Group drive.

Total connected horsepower, 215. Number of motors installed, 6. Average kilowatt-hours per month, 12,664.

Kilowatt-hours consumption for 12 months: January, 1,897; February, 1,593; March, 1,745; April, 2,156; May, 13,970; June, 1,782; July, 17,653; August, 19,689; September, 24,731; October, 27,917; November, 13,970; December, 24,870.

Load-factor, 11.8 per cent; operating-time load-factor, 22.6 per cent.

The average total electric energy consumption per 1,000 brick is 26.4 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60-cycles, 220-volts. The motors are of the squirrel-cage induction type.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	840	Geared to a nine-foot dry pan and belted from extension shaft of dry pan to a 40-foot bucket conveyor.
1	40	840	Geared to a nine-foot dry pan and belted from extension shaft of dry pan to a 40-foot bucket conveyor and a 50-foot by 24-inch belt conveyor.
1	40	840	Geared to a No. 51 pug mill.
1	15	1,120	Belted through countershaft to a 140-inch blower. Speed 216 revolutions per minute. (Supplying draft for ovens.)
1	5	1,700	Belted to a 72-inch disk fan.
1	75	685	Geared to a No. 1 Giant brick auger (capacity 6,000 per hour). From the countershaft of brick auger is belted a 30-foot shaft (four hangers) which drives an 18-brick automatic cutter (three belt conveyors, 6-foot, 25-foot and 50-foot respectively), and a 10-foot bucket conveyor and repress.

All brick-making machines were supplied by the American Clay Machinery Company. Energy is supplied by the West Penn Electric Company.

Dry Pressed Brick Company, Sandpoint, Idaho. Manufactures pressed brick. Group drive. Running hours per week, 60.

Total connected horsepower, 117.5. Number of motors installed, 3. Average kilowatt-hours per month, 13,947. Average kilowatt-hours per month, per connected horsepower, 119.

Kilowatt-hours consumption for five months: April, 15,150; May, 18,280; June, 16,260; July, 15,780; August, 4,328.

Load-factor, 26 per cent; operating-time load-factor, 45.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60-cycles, 220-volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	75	720	Belted to a line shaft driving one Andrews brick press, No. AA-110, capacity 1,800 bricks per hour; one Andrews brick press, No. AA-114, capacity 1,840 bricks per hour; one clay mixer and feeder; one Scott pulverizer; one 6 by 10-inch bucket conveyor, speed 160 feet per minute; one 6 by 10-inch bucket elevator, speed 500 feet per minute; one nine-foot clay mixer; and one 12-inch double-drum hoist, speed 200 feet per minute.
1	35	900	Belted direct to one nine-foot exhaust fan. Speed of fan, 300 revolutions per minute.
1	7.5	1,800	Belted to countershaft driving one coal conveyor. Speed of conveyor, 200 feet per minute; capacity, 10 tons per hour.

Energy for this installation is supplied by the Northern Idaho & Montana Power Company.

Brick-Plant Data—Sheet No. 2.

Brick plant, name withheld, manufactures special forms of fire brick used in the steel-making industry. The monthly output averages 1,300 tons of brick, one-third of which is hand molded. Group drive. Running hours per week, 108. (Two nine-hour shifts daily.)

Total connected horsepower, 157. Number of motors installed, 8. Average kilowatt-hours per month, 13,650.

Kilowatt-hour consumption for 14 months: June, 8,080; July, 6,990; August, 11,100; September, 11,110; October, 13,050; November, 14,710; December, 14,610; January, 15,070; February, 17,340; March, 17,120; April, 17,670; May, 18,170; June, 15,460; July, 10,630.

Load-factor, 15.8 per cent; operating-time load-factor, 17.8 per cent.

The total electrical energy consumed per ton of output is approximately 12.2 kilowatt-hours.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60-cycles, 220-volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	40	850	Slip-ring motor belted to a Chambers Brothers suspended-type nine-foot dry pan, with a 40-inch by 12-inch pulley running at 210 revolutions per minute. A 58-foot bucket elevator to a gravity screen is driven from the dry-pan shaft.
1	40	850	Slip-ring motor belted direct to an E. M. Freese 12-foot pug mill. Mill runs 200 revolutions per minute.
1	50	850	Slip-ring motor belted to a No. 1 Giant "American" brick-making machine, capacity 60,000 brick in 10 hours.
1	5	1,700	Belted to a "Tempest" brick press making 30 strokes a minute. A bucket elevator carrying waste from press to auger is driven from the press.
1	5	1,700	Belted to a 12-foot two-bearing line shaft driving a "Tempest" brick press, making 20 strokes per minute, and an 18-inch bucket elevator carrying waste from press to auger. The line shaft also drives a 20-brick cutter table with 14-inch conveyor belt.
1	10	1,120	Belted to a 40-foot, four-bearing line shaft which drives a Bonnot repress. Capacity 2,500 brick per hour, average output 2,200 brick per hour. Seldom used.
1	5	1,120	Belted to an 18-foot line shaft driving one 24-inch shaper; one 14-inch drill press; one 20-inch engine lathe; one 15-inch engine lathe; one 12-inch emery wheel and a 20-inch rip saw.
1	2	1,700	Belted to a 32-inch pulley on Tranter pump, three-inch suction, 38 strokes per minute, 115-foot head.

All motors are of the induction type, those not otherwise specified being squirrel-cage machines.

Albany Brick Company, Albany, Ore. Manufacturers of building brick. Group drive. The running hours per week varies.

Total connected horsepower, 35. Total number of motors installed, 1. Average kilowatt-hours per month, 2,922. Average kilowatt-hours per month, per connected horsepower, 83.6.

Kilowatt-hour consumption for four months: May, 1,400; June, 3,640; July, 4,210; August, 2,440.

Load-factor, 18 per cent.

The average electrical energy consumption per 1,000 bricks made is 8.16 kilowatt-hours.

MOTOR INSTALLATION.

The motor installed at this plant is a 60-cycle, 2,300-volt induction machine.

No.	Horse-power.	Speed R. P. M.	Application.
1	35	1,200	Belted to a line shaft driving: One Potts disintegrator with clay elevator, capacity 30,000 per day; one eight-foot pug mill; one Bucyrus Acme brick machine, capacity 25,000, with carrying-off belt for same.

Energy for this installation is supplied by the Oregon Power Company.

Coffyville Brick Company, Ft. Smith, Ark. Manufactures building brick. Combination drive. Running hours per week, 60.

Total connected horsepower, 55. Number of motors installed, 2. Average kilowatt-hours per month, 3,220. Average kilowatt-hours per month, per connected horsepower, 58.

Kilowatt-hour consumption for 10 months: January, 3,292; February, 3,279; March, 3,355; April, 1,639; May, 1,801; June, 1,855; July, 4,480; August, 5,510; September, 4,865; October, 2,122.

Load-factor, 12 per cent; operating-time load-factor, 22.5 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60-cycles, 220-volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	50	900	Belted to a line shaft driving one nine-foot dry pan; and two 40-foot bucket conveyors.
1	5	1,800	Geared direct to one Universal brick-setting machine.

Energy is supplied by the Ft. Smith Light & Traction Company. Part of the drive in this plant has not as yet been replaced by motors.

velocity of the issuing clay column was too great for satisfactory results; this fact determined the selection of a variable-speed motor capable of operating continuously at 80 per cent of its normal speed.

Other factors such as the necessity of frequent starting under full-load conditions, the excessive torque required when the cutting knives and shaft of the auger become entangled with roots, and the desirability, at times, of reversing the mill for short periods, resulted in the final adoption of a 100-horsepower 600 revolutions per minute, 550-volt, induction motor with phase-wound rotor and external secondary resistance which fully met all of the above requirements. The actual load, by test, varies from 125 to 150 horsepower, depending largely upon the degree of moisture in the clay. The conservative temperature rating of these motors is forcibly indicated by the fact that after a ten hours' run under continuous load ranging from 140 horsepower to 150 horsepower the temperature rise of the hottest part of the motor was but 35 degree centigrade.

A clay granulator capable of supplying approximately 25-per-cent more material than is normally required, feeds these brick machines. The considerations affecting the choice of motors for these granulators were very similar to those outlined above, namely, high torque, frequent starting together with long periods of heavy continuous duty and occasional necessity for reversal. An induction motor, 75 horsepower, 720 revolutions per minute, 550 volts with a starting torque equivalent to approximately three times normal full-load torque was, therefore, chosen.

In addition to the above mentioned motor-driven brick machinery a centrifugal pump is installed at the clay pits to dispose of the seepage. This pump is direct connected to 25-horsepower, 600 revolutions per minute, 550 volt induction motor and has a normal capacity of 1,000 gallons per minute.

The power for this plant is purchased from the Central Georgia Power Company at 4,500 volts and stepped down on the customer's premises to 550 volts by means of a bank of oil-cooled 100-kilowatt transformers.

Commercial Practice
Management, Rates, New Business

Converting the Engineer of the Isolated Plant.

Central-station men probably agree that one of the greatest obstacles to the introduction of electric central-station service in many plants is the opposition of the engineer of the private plant, who opposes the change because he believes that his services would be dispensed with if the central station were to wire the building and furnish current. The task of convincing the engineer that he can be just as useful to his employer and just as valuable to the factory from a power standpoint with electric drive and central-station service as before, is no small one, yet the Louisville Lighting Company's publicity department appears to be making considerable headway in this direction.

A recent advertisement, addressed directly "To Engineers," appeared in a Louisville daily, in which the following arguments were presented: "Suppose you recommended the Louisville Lighting Company's service for your plant, and suppose that recommendation was adopted. What would be the effect on your job? Would your job be a smaller job or a bigger job? Answer these questions by asking yourself another question. What is it for which you are paid your salary? For seeing to it that your building is always adequately lighted; for having that building warm when heat is needed—comfortable under all circumstances; for constantly keeping the elevator service in good shape; for having the right light, heat and power when they are needed, and for procuring them at the lowest possible cost.

"Your employer is not interested in the manner in which you procure light, heat and power, but in the quality and cost of the service. Show him that the introduction of the Louisville Lighting Company into his building means a better service at a lower cost, and you at once become a more valuable man in his eyes.

"Relieve yourself of all the dirt and petty detail of generating power in your own building, and you have more time and a better opportunity of attending to the big things—the brain part—of your job. And immediately your job becomes a bigger job.

"You can't serve your employer's interest—nor your own—by opposing modern methods. The only way is to take advantage of them."

Solicitors Must Specialize.

The Kentucky Electric Company, of Louisville, Ky., has put into use in its new-business department a plan of specialization which President R. E. Hughes reports is having good results. Instead of having each solicitor handle all kinds and classes of business, he is trained along some particular line, his effectiveness thereby being considerably increased. The lighting department is in charge of L. J. Hannah, who has 14 men under him, and the power division is operated by W. D. Myers, who uses six solicitors. Of course both factors are involved in the same work occasionally, but the department which has most work to do in connection with the installation handles it. In the power department, also, it has been found advisable to work out a plan for creating experts in various manufacturing lines, so that solicitors have been developed individually, some in connection with saw mills, furniture factories, planing mills and other woodworking plants; foundries, machine shops, boiler plants, and similar iron and metal-working industries, and others as to woolen and cotton mills and textile plants generally. Thus when an inquiry comes in or a new line of business is being solicited, it is usually possible to put on the work a man who has some practical knowledge of that particular industry.

Brooklyn Electric Rates Reduced.

Following its policy of reducing rates whenever economies in operation or conditions of development warrant, the Edison Electric Illuminating Company of Brooklyn has announced a material reduction in rates for electric service, effective July 1, 1912. The reduction especially affects the retail consumer, but also results in materially lower rates for the long-hour burners now operating under the present intermediate and wholesale contracts. The present rate for retail lighting is 12 cents per kilowatt-hour. On July 1 the present retail, intermediate and wholesale forms of contract for electric service will be discontinued. The new rate will contain the following sliding scale of charges for current used

and will be available without the guarantees heretofore required under the present intermediate and wholesale schedules, the only requirement under the new schedule to obtain service being a current use of $12 per meter per year, as under the present retail form.

The new rate schedule provides a charge of 11 cents per kilowatt-hour for the first two hours' average daily use of the maximum demand; 8 cents per kilowatt-hour for the third and fourth hours' average daily use of the maximum demand; and 4 cents per kilowatt-hour for all energy consumed in excess of four hours' average daily use of the maximum demand. The maximum demand will be figured as a percentage of the installation, 50 per cent being used for residences, 70 per cent for all other premises, each standard socket being rated at 50 watts, and 1.5 kilowatts being the smallest demand upon which any bill will be figured. Either customer or company, in lieu of the above computed demand, based on percentage of installation, will have the option of using a standard type of demand indicator to register the demand, a charge of $1 per month being made to cover the maintenance of the instrument, installed for a period of one year. The guarantee under the present special wholesale contract will be reduced from $3,000 to $2,400 per year, billed $200 monthly.

Electric Trucks in Louisville.

The Louisville Lighting Company has begun work in the direction of replacing all of its horses and wagons in its construction, distributing and maintenance departments with electric trucks. P. T. Glidden, general manager of the company, who has charge of the change, intends to make it gradually, so as to give a thorough test to the equipment as it is installed, but he believes that the truck will prove not only more serviceable but also cheaper to maintain. This is particularly true, for example, in the maintenance of arc lamps. Two-wheel carts are used for these, and two horses have to be kept for each cart, as the work is hard, especially in hot weather. A light truck will do the work better and the cost of running it should be much less than the $50 a month required to feed two horses. One Walker, a 3,000-pound car, has been purchased, and several other trucks will be secured in the immediate future. The total number used, if the plan goes through in its entirety, will be between 15 and 20.

Operating Data of Electric Truck in Davenport.

The accompanying table gives complete operating data on a 2,000-pound electric truck which the Peoples Light Company has had in continuous service since May, 1910. The net earnings for each month are obtained by deducting the expenses of the electric from the cost of maintaining a similar horse-drawn equipment, comparisons being made with actual cost figures compiled by the company on horse service for the same month.

Month	Mileage	Kilowatt-hours Consumed	Kilowatt-hours Per Mile	Gross Earnings	Charge for Current at 6 cents	Charge for Operation	General Expenses	Depreciation	Net Earnings
1910									
May	644	393	0.61	112.50	23.58	60.00	....	45.00	*(16.08)
June	761	382	0.5	167.95	22.92	60.00	....	45.00	40.03
July	732	399	0.55	154.25	23.94	60.00	.35	45.00	24.96
August	668	340	0.508	140.00	20.40	60.00	....	45.00	14.60
September	634	284	0.447	118.50	17.04	60.00	....	45.00	*(3.54)
October	591	266	0.45	118.30	15.96	60.00	....	45.00	*(2.66)
November	596	153	0.26	137.50	9.18	60.00	15.39	45.00	7.93
December	525	153	0.29	98.25	9.18	60.00	6.51	45.00	*(22.44)
1911									
January	328	220	0.67	69.25	13.20	60.00	5.35	45.00	*(54.30)
February	334	264	0.79	99.15	15.84	60.00	5.50	45.00	*(27.19)
March	651	334	0.51	153.00	20.04	60.00	2.22	45.00	25.74
April	586	408	0.70	192.70	24.48	60.00	16.70	45.00	46.52
May	715	505	0.706	211.20	30.30	60.00	1.95	45.00	73.95
June	706	576	0.815	245.70	34.56	60.00	....	45.00	106.14
July	236	412	1.645	158.20	24.72	60.00	2.50	45.00	25.98
August	550	453	0.823	208.40	27.18	60.00	13.79	45.00	62.43
September	461	612	0.753	206.35	36.72	60.00	3.50	45.00	61.13
†October	....	....	....	....	....	....	....	....	....
November	374	147	0.39	173.35	8.82	60.00	17.64	45.00	41.89
December	452	391	0.86	167.88	23.46	60.00	2.00	45.00	37.42
1912									
January	516	392	0.60	181.80	23.52	60.00	1.00	60.00	37.28
February	450	540	1.2	154.80	32.40	60.00	....	60.00	2.40
March	358	460	0.128	146.80	27.60	60.00	2.10	60.00	*(2.90)

*Net loss shown in parenthesis.
†Truck was laid up for repairs during this month.

Central-Station Power for Woodworking.

The argument that woodworking factories cannot well utilize electric current because of the fact that this prevents their operators from utilizing their waste products for fuel seems to have been disposed of by Louisville central stations, who have succeeded in installing motors in a number of large woodworking plants in that city, which is a prominent manufacturing center and has many plants consuming wood. The Louisville Lighting Company has contracted to furnish current to the Louisville Veneer Mills, which will operate a large number of veneer saws, rotary machines, glue machines and presses with electricity, and has completed preparations for serving the Globe Casket Company. The former is a going concern, and has been generating steam for power purposes, while the latter is a new concern. The Kentucky Electric Company of Louisville has also been active in this direction and has recently contracted for the current to be consumed by the Louisville Planing Mill Company, the new plant of which is now being erected, following a fire which destroyed the old one. This company has been using motors heretofore.

Expansion at Grand Island.

The growing consumption of current in Grand Island, Neb., has caused the Grand Island Electric Company to largely increase its capacity. A new building of modern design has recently been completed and new machinery installed, consisting of a 500-kilowatt Curtis steam turbine and a 150-kilowatt General Electric generator, together with new switchboard equipment, etc.

The company, of which T. H. Fritts is manager, is contemplating the installation of an additional steam turbine of 500 kilowatts.

Additional Electric Service for Lincoln, Mass.

The consumption of electricity in the town of Lincoln, Mass., has increased so rapidly since the introduction of Edison service into that town that it has become necessary for the Edison Electric Illuminating Company of Boston, to construct additional lines to its substation there.

Meter Charge Discontinued.

In Elwood, Ind., the opposition of patrons to a meter charge of 25 cents a month has become so great that the Elwood Electric Light Company has discontinued this method of charging.

Electrical Construction

CONDUIT VERSUS OPEN WIRING FOR PLACES EXPOSED TO DAMPNESS OR CORROSIVE VAPORS.

By F. G. Waldenfels.

A brief statement of the purpose of this paper is probably desirable, so that the reader may know from the first just what subjects will be discussed and how these subjects will be treated. For several years the writer, working either as an electrician or as an electrical inspector, has been carrying on some careful investigations with a view to determining what sort of electric wiring is best suited for such service as is required in the large meat-packing houses in Chicago. These notes will describe in some detail the kinds of wiring that have been tried. Moreover, the objections to various types of construction will be explained. It is hoped that in this way the relative advantages of different types of wiring will be brought out.

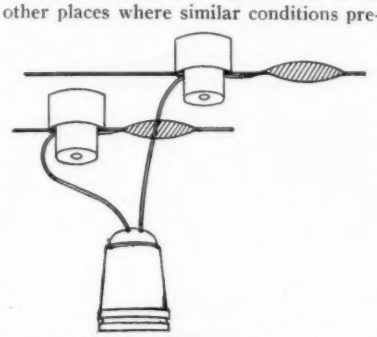


Fig. 2.—Star Ideal Knobs Used to Support Both Line Wires and Drop.

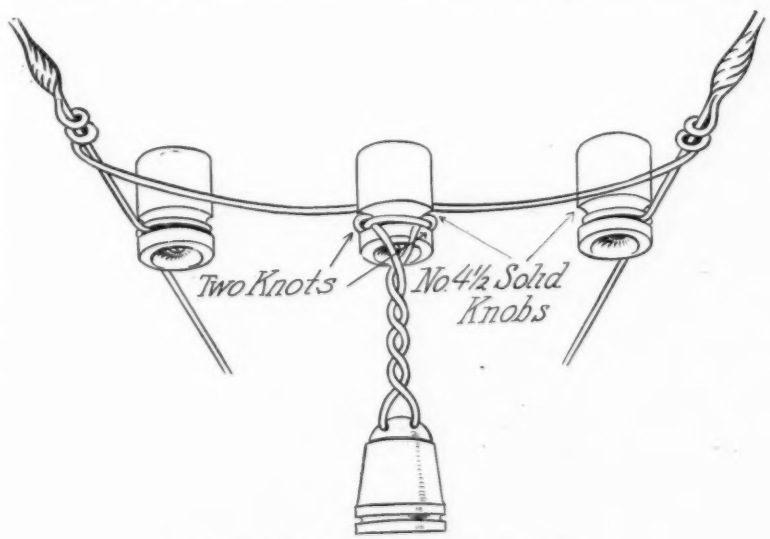


Fig. 1.—A Faulty Method of Anchoring Drop.

It is understood, of course, that of the total number of men engaged in electrical construction over the country the number interested in packing-house wiring, as such, is relatively small. But very many of the construction details employed here may be used to advantage in wiring for service of various other kinds. Hence it is hoped that this discussion will prove to be of interest to those engaged in general electrical construction as well as to those who have to install wiring in packing houses, or in other places where similar conditions prevail—as, for example, in breweries, tanneries, fertilizer factories, and the like.

In portions of meat-packing plants the electric wiring is subjected to the severest conditions imaginable. Some rooms are always dripping wet from ordinary condensation which collects on everything. In others water drips from ceilings and runs through the floors below to perhaps other ceilings. Some rooms, also, are generally filled with dense steam. In the pickling departments there is a salty atmosphere, while in glue and tank rooms corrosive vapors have to be contended with. Moreover, there are places where the temperature is always high, and others still where it is constantly exceedingly cold.

Until not very long ago it was thought that exposed wiring was the only kind of construction at all suitable for places in which conditions such as those enumerated above are encountered. In fact, this opinion prevails widely now, it seems. In the Chicago packing houses the expense of repairs on open wiring was so great, however, that experiments with conduit work were undertaken. These experiments, though, which, it may be added, are still in progress, will be taken up later on in this discussion. It is proposed to take some account first of open wiring, every form of which, it is believed, has been tried in the plants mentioned. Numerous types of supports for circuits have been tried out here, and the fitness of various kinds of wires, knobs, screws, sockets, cutouts, cabinets, switches and other fittings determined.

In very wet places, with water on floors walls and ceilings, it is important that the electric-wiring installation be one possessing the best of insulating qualities, and particular pains must be taken, too, to keep the circuits free from grounds. Furthermore, all joints should be properly made, taped and then compounded.

In places of this sort we recommend the use of composition or hard-rubber sockets. The porcelain socket is good if these are not dropped so low as to make them liable to accidental breaking by objects moved around the room in the course of the day's work. Where keyless sockets are dropped low on cords troubles have arisen from the twisting off of the cord just above the socket. Workmen will persist in giving the lamp a turn in the socket to extinguish the light, instead of putting the light out by means

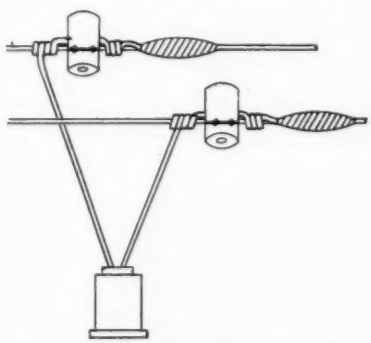


Fig. 3.—A Common Method of Installing Weatherproof Sockets.

of the proper switch. In turning the lamp, the cord is twisted, and it may happen that so many of the strands are broken that the remaining ones fuse and start destructive arcs. The fire hazard thus introduced is by no means inconsiderable. To overcome this sort of disorder we have had brass key sockets tried out, and, though the statement may seem strange, they have given more satisfactory results than the standard weatherproof sockets themselves. We require these brass sockets to be painted with white lead, after which they are taped with friction tape; and finally a second coating of white lead or a coating of asphaltum is applied. The No. 14 stranded wires entering the three-eighths-inch opening in the cap of the socket are taped and then compounded with Chaterton compound, to keep out moisture. In this way a durable, waterproof socket, not susceptible to corrosion, and by means of the key in which the lamp may be turned on or off at the socket without any twisting of the cord, is obtained.

In damp places and those subject to corrosive gases, the covers of all snap switches should be painted with asphaltum or lacquer. It is good practice, also, to cover the blades of knife switches with vaseline or lacquer, and terminals on cutouts may be given a coating of vaseline to advantage.

Types of Exposed Wiring.

Where ceilings are low, certain methods of open-knob wiring are frequently employed in damp rooms. A common type of work of this kind is shown in Fig. 1. Here No. 4.5 standard solid porcelain knobs are employed both for line supports and for anchors for drops. An objection to this sort of wiring is that two knots are necessary in the No. 14 stranded rubber-covered wires used for drops in order to secure them to the solid knobs which serve as anchors. From the knob the drop wire is carried to the line wire, around which it is given several turns before the joint is made. Such twisting of the wire tends to destroy the insulation. In many cases the insulation has been worn through at the knots because of strain exerted on the lamp or on an extension made there.

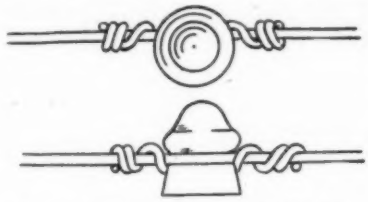


Fig. 5.—Correct Method of Making Tie.

When the line wires are put up they are given a turn around each of the solid knobs, as indicated in the figure. The knobs are very liable to be knocked off the surface wired over after the circuit is put into service. Of course, when a knob falls out the turn which the wire made around it leaves the circuit slack and in bad shape.

In places where the ceilings are higher —nine feet or over—what is known as the pin-and-insulator system of wiring is often employed. The construction of the circuit in wiring of this sort is indicated in Fig. 8. Hangers are made of 2-by-4-inch dressed lumber, the timber being usually painted with a red, mineral paint. The parts of the supports are fastened together with three-eighths-inch galvanized-iron bolts. Ordinary glass, petticoat insulators are screwed on wooden pins of the usual type set vertically in the cross-arm supported by the hangers just referred to. Tie wires are used in the customary manner to fasten the line conductors to the insulators. Two correct methods of making the tie are shown in Figs. 5 and 6.

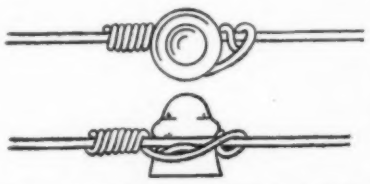


Fig. 6.—Another Correct Method of Making Tie.

In packing-house work we have generally used No. 12 wire for the pin and insulator circuits having a rubber covering three-thirty-seconds of an inch thick —that is rubber-covered wire having twice the ordinary thickness of rubber in the insulation.

No. 14 stranded, rubber-covered wire is employed for drops, and these last are generally anchored from standard No. 4.5 split knobs. The grooves in one of these knobs separate the wires an inch where they pass through it. Very often drops are anchored from the line wires after a few turns, but this procedure should be discouraged.

Pin-and-insulator wiring has the disadvantages of being expensive to install and of taking up too much room. Where it is employed it is frequently damaged by pipe fitters and other workmen, and thus the cost of repairs introduces a still further objectionable feature.

The wire support illustrated in Fig. 10 is sometimes employed in wiring in wet places. This support, which is known as the inverted tee, gives the circuit an insulation which is next to that afforded by pin-and-insulator wiring. It will be observed, for example, that there can be no tendency for water to run down the knobs to the wires, as always happens when wires are fastened by means of knobs to such a surface as a wet ceiling. This scheme of wiring is much more expensive than ordinary exposed wiring, of course.

In Fig. 4 split knobs are shown. In

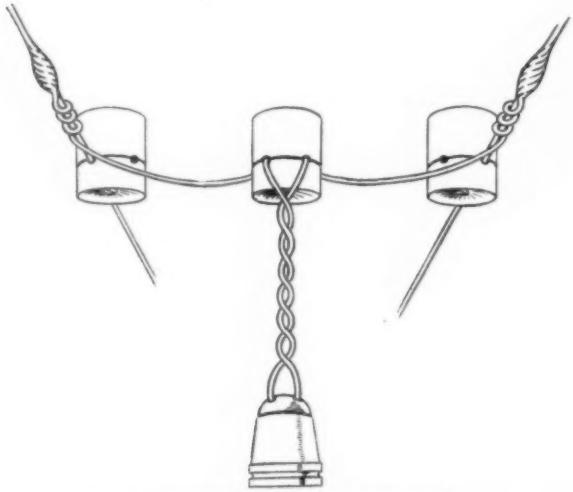


Fig. 4.—Exposed Wiring with Split Knobs.

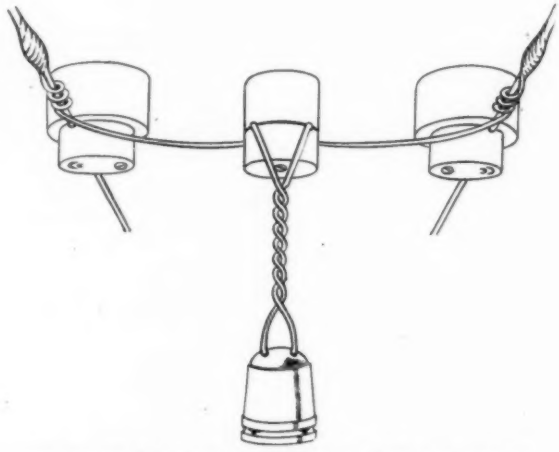


Fig. 7.—An Approved Installation of Star Ideal Knobs.

our territory the No. 4.5 split knob has completely replaced the solid knob. The split knob has the advantage that it eliminates the necessity of knotting the wires about knobs and thus improves the life of the insulation. Moreover, the running of a given circuit with split knobs is the

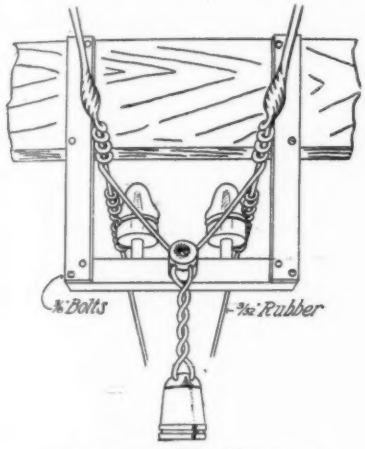


Fig. 8.—Pin-and-Insulator Wiring.

quickest sort of a job. When solid knobs are used two men are needed to run a circuit—one to keep the wire pulled taut and the other to wrap it around the knobs. On the other hand, with split knobs it is only necessary, in putting up a straight run of wire, to fasten the wire at each end of the run and then install the knobs four and a half feet apart along its length.

A further advantage of the split knob is that if a knob in a circuit happens to be broken off the wire does not become slack necessarily.

Some electricians prefer to use a solid knob where a wire is deadened, but a skilled wireman can make just as good a job with a split knob.

Another two-piece knob known as the "Star Ideal" knob is a very serviceable one. It is illustrated in Figs. 7 and 8. In putting up a circuit with knobs of this kind, the ends of the wires are generally fastened with solid knobs, and the two-piece knobs then installed four and a half feet apart between the ends of the run. Screwing the cap on the knob tightens the wire.

While with knobs of the kind just mentioned used to support a circuit anchors for drops are generally made by means of split knobs, this is not at all necessary; the two-piece knob may be used as an anchor. Fig. 2 shows knobs of this sort used as a support for line wires and at the same time to anchor drops.

In Fig. 9 another type of open wiring is illustrated. The running boards to which the knobs and cleats are attached are usually made of dressed boards one inch thick and six inches wide, painted with asphaltum or mineral paint The boards protect the wires very well from mechanical injury, and the construction is, on the whole, a very good one where there is not much moisture.

If, as shown in the figure, packing-house cord is used for drops, these should be anchored with a pair of single-wire cleats. With stranded No. 14 wire for drop, we prefer No. 4.5 split knobs for anchors. When switch legs are necessary, they can readily be run down neighboring columns or walls, but snap switches should be mounted in condulets.

This kind of work, it may be added, costs as much as exposed conduit construction.

Still another type of open wiring which has been tried out in wet places is the so-called trough wiring illustrated in Fig. 11. Descriptions of this kind of wiring have appeared lately; in fact, but little description of it further than that afforded by the figure is necessary. As the work is installed in Chicago, V-notches are cut in pieces of timber which are 2 inches thick, 9 inches long and 6 inches wide. The timbers are secured to the surface wired over in the manner indicated and an inverted trough installed in the V-notches. The trough is made of 1-by-6-inch boards, dressed and painted. V-shaped blocks inside the trough furnish supports for the anchor knobs.

The trough affords good mechanical protection for the wires, and also keeps water from dripping on the circuit from above of course. But this sort of work is expensive. Good carpenters and good electricians are needed to put it in. In some cases the completed trough alone, not installed, has cost six cents a linear foot. Moreover, we have not found the life of this work to be long. In one of the packing houses, the trough circuits had to be replaced about every six months.

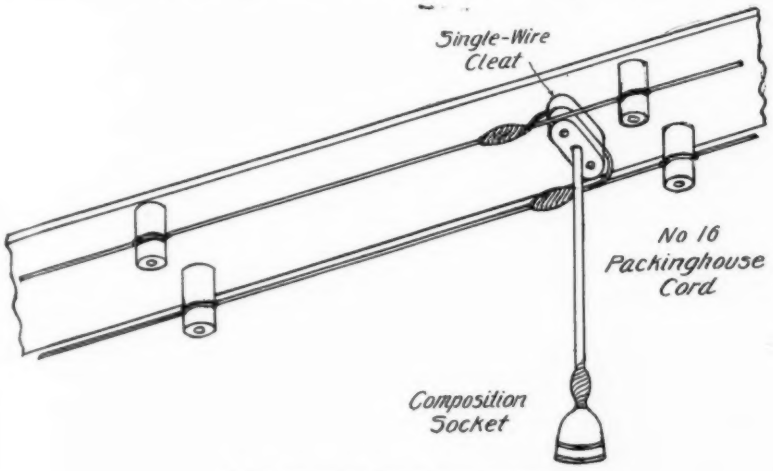


Fig. 9.—Running-Board Construction.

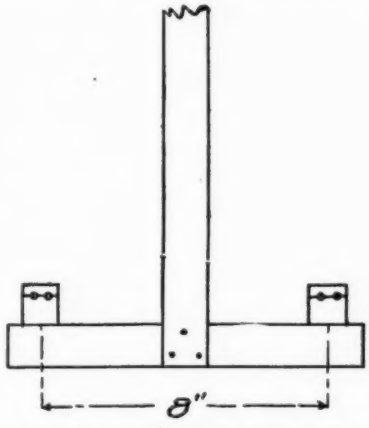


Fig. 10.—Inverted Tee for Supporting Wires.

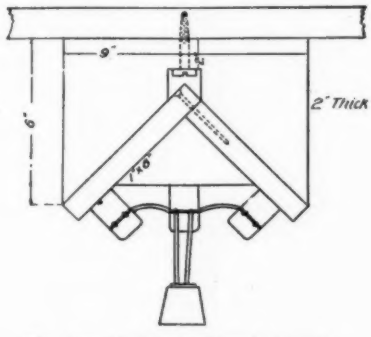


Fig. 11.—Section of Trough Circuit.

Finally it was decided to try conduit in this department. Conduit work was put in two years ago and is still giving satisfaction. A more detailed account of our experiments with conduit construction will be given later.

Carnegie School Changes Name.

By act of Legislature of the State of Pennsylvania, dated April 20, a charter of incorporation, with the power to grant degrees, was given to the Carnegie Technical Schools, and the name of the institution changed to the Carnegie Institute of Technology.

Wiring for Motors in a Speedometer Factory.

In the manufacture of speedometers conditions not generally found in work of other kinds are met with. There is an unusually large number of small machine tools and testing appliances to be driven, and in the operation of some of these a closely graduated speed control over a wide range of values is very desirable. If group drive is employed, there will not be the flexibility of speed control so desirable in certain departments, and, because of the large number of small machines in some of the rooms, the loss of power there in belts and shafts will be unusually great. On the other hand, if individual drive be employed, the problem of wiring to the small motors in such a way as to insure a safe, permanent job at a reasonable cost and not to make the appearance of the wiring in the room containing many small motors bad, is one which may require considerable thought.

The Stewart & Clark Manufacturing Company, of Chicago, operates one of the large speedometer factories of the country. In the department where completed speedometers are tested, group drive was employed until a little while ago. There is individual drive here now, however.

Under the old arrangement a 25-horsepower motor was used to drive the line shafting; now a 3.5-horsepower motor-generator set is found ample for supplying current to run the small motors which operate exactly the same appliances as were used before. The testing sets are arranged on long rows of tables and the motor for driving each set is attached to the under surface of the table, directly below the testing apparatus. The motors are all direct-current machines, supplied with power from the direct-current generator side of the motor-generator set just mentioned, and there is a speed-control rheostat within easy reach of each operator for varying the speed of his particular motor.

The electric wiring in the room is all exposed conduit work, with condulet fittings. Rigid conduit is run along the ceiling from the main cut-out cabinet to points convenient for making vertical drops to the various groups of motors. The wiring to the motors under the table is in flexible metal conduit. There are cutout and switch cabinets at all necessary points.

As a high-class job, the wiring in this room is hard to beat. The installation was designed by Ignatius Bond, of Bond Brothers & Company, electrical contractors, of Evanston, Ill. This firm installed the work also.

TEMPORARY WIRING.

By H. G. Wilson.

It is quite common now-a-days for temporary wiring to be installed for supplying current to lamps intended to provide special illumination for one purpose or another. It's unfortunate, too, that it has to be admitted that *temporary* as the word is here used is often a synonym for *defective*. However, work of the kind in question is sometimes installed in such a way that it is a pleasure to look at it. An installation like this was recently seen by the writer in a large dry-goods store.

In the store referred to it was desired to obtain a festoon effect with colored lights. The wiring was done so as to make this effect possible, and also so as to make the installation perfectly safe. Moreover, the wiring can be taken down and restored again very readily whenever it is desired to use it in the future.

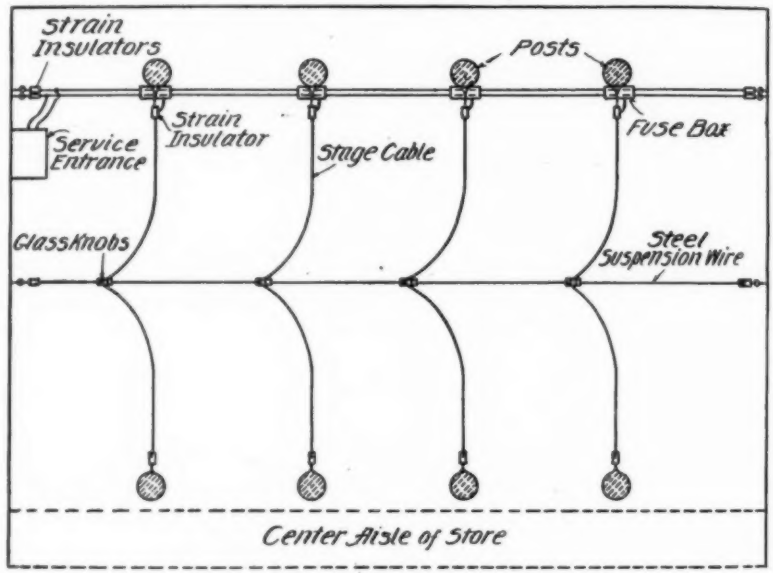


Diagram of Wiring in One Side of Store.

A feed circuit, tapped off the service entrance in the rear of the store, was run through cutout cabinets, one on each of the posts supporting the roof and about 14 feet apart. The feed circuit was suspended at both ends with glass strain insulators fastened to the walls with hook-and-eye bolts.

Through the center of the two lines of posts a steel messenger wire was supported in like fashion, to which was fastened the center of the festoons by means of glass knobs and tie wires.

Stage cable was used for circuit wires, these being suspended by glass insulators at both ends, and taps taken off the cable with staggered joints for twenty two-candlepower lamps.

With care this can be taken down and used over and over again, and at the same time retain its pleasing appearance from the construction viewpoint.

Electric Motor Troubles.[1]

In the operation of induction motors trouble is sometimes experienced from the sudden stopping of the machine even though the load does not exceed the rated value. The common cause of this is the rubbing of the rotating member, or rotor, as it is called, against the teeth of the stationary part, or stator. The air gas of the induction motor is usually made very small, for the sake of keeping the power-factor as high as possible. Hence when the motor stops the air gap should be investigated.

Low voltage on the line is another cause of induction-motor trouble. If the motor load is unsteady and the line voltage low, the machine may stop and the fuses be blown as the load quickly swings to some relatively large value. The torque, or turning effort, of a motor of the kind in question is proportional to the square of the applied voltage. In other words, reducing the voltage to half its correct value reduces the torque to one-fourth the proper value. Trouble is sometimes experienced in starting an induction motor because it is attempted to start it on too low a voltage. Low voltage on a motor may be caused by an unbalanced voltage on the line.

Vibration in an induction motor may be due to the fact that the shaft is

1 Abstract of an article from the *Electrician and Mechanic.*

sprung, or it may be that there is an unbalanced magnetic pull on the rotor due to an uneven clearance in the air gap or to the eccentricity of the rotor.

If one phase of the stator on a Y-connected three-phase motor is open-circuited, the motor will not start; if it is started mechanically, it will run as a single-phase motor and the load it can carry will be materially reduced. An ammeter connected in each phase will give current readings in only two of them. If the motor is delta-connected, current will flow in each lead, but the currents will be unbalanced. In either case, if the machine is not started mechanically, the rotor will remain stationary and simply act as the secondary of a transformer. The whole machine will rise to a high temperature, and the conductors on the rotor may be badly burned in as many places as there are poles in the stator winding.

The faults which may develop in direct-current motors are: Sparking at the brushes; heating of commutator, armature, or bearings; noisy operation; running at wrong speed; and failure of motor to start.

Sparking at the brushes is not usually objectionable, if moderate in duration and amount. If allowed to continue beyond these limits it will burn and roughen the commutator, thus aggravating the difficulty. Sparking may be caused in several ways, among which are: too much current on armature, brushes not set at neutral point, commutator has high bars, or poor brush contact. To decrease the effect of sparking on account of the armature carrying too much current, the driven load should be reduced, the strength of the magnetic field should be increased or the size of driving pulley decreased. If the motor starting-box has too little resistance, it will cause the motor to spark badly at first, owing to a very sudden start. In this case the only remedy is an increase of resistance to cut down the voltage applied to the armature terminals.

To find the correct neutral position for the brushes, carefully shift the brushes backward or forward until sparking is minimized. If the brushes are not exactly opposite in a two-pole machine or 90 degrees apart on a four-pole machine, they should be made so by counting the commutator bars and dividing by either two or four, as the case may be. To remedy high bars on the commutator or flat bars or projecting mica, smooth the commutator with a fine file or fine sandpaper, the latter being applied by a block of wood which exactly fits the commutator. If, however, the commutator is very rough or eccentric, it should be turned down in a lathe. On large machines, a slide-rest attachment is usually provided for either turning off or grinding the commutator without removing the armature from the bearings. To improve the brush contact, draw a strip of sandpaper back and forth beneath the brush with the rough side scraping the carbon. See that the brush holders work freely; lack of this may be the cause of poor brush contact.

Armature heating may be caused by moisture in the armature, unequal strength of magnetic poles, or by excessive current in the armature coils. Excessive eddy currents in the armature core may cause heating, too. Heating from this last cause may be distinguished by the fact that it is not accompanied by any sparking at the brushes. If there are excessive eddy currents in the conductors and not in the iron, this will be shown by the conductors becoming hotter than the iron on no-load running. In this case the conductors should be reduced in thickness, or else they should be split up into a number of strands, which should be twisted together. Beveling off the edges of the pole pieces may also reduce the trouble.

If for any reason a motor armature has become damp, it may, in the case of a small machine, be dried by being placed in an oven kept at the proper temperature, while a larger armature can usually be dried by holding about three-fourths the normal full-load current on it continuously until it is dry, the armature being turned over occasionally in the meantime by hand.

Unequal strength of magnetic poles will, in the case of motors having multipolar fields and parallel windings in the armature, cause excessive currents to flow in the armature and thus to heat it. The trouble usually is that the armature is closer to some of the poles than to others, and the disorder may be corrected by slightly shifting the bearings, but in some cases, especially when direct-connected, it is preferable to shift the field magnet. When the armature gets out of center from too much bearing wear, however, the proper procedure is to replace the bearings with new ones.

Heating of the commutator, like sparking, may occur in direct-current machines, and in the commutator types of alternating-current machines. There are various causes for commutator heating, among which are: Heat spread from another part of machine, sparking, carbon brushes heated by current, friction of brushes on commutator or bad connections in the brush holder. If the heat in the commutator comes from another part of the machine, start up the motor with the parts cool and run for a short time. The seat of the trouble is in the part that heats first. Any of the causes of sparking will cause heating, which may be slight or serious.

An overheated commutator will decompose carbon brushes and cover the commutator with a black film which offers resistance to the efficient collection of current. Carbon brushes require less attention than copper, because they do not cut the commutator and their high specific resistance usually reduces sparking, but it may also cause them to heat more than copper brushes. The friction produced by the brushes will generate heat, which can be detected even when the brushes carry little or no current. Reduce the spring tension and decrease voltage, keeping up speed by weakening field strength.

The cause of bearings heating should be found and removed promptly, but heating may be reduced temporarily by applying cold water or ice to them. This should be resorted to only when it is absolutely necessary to keep running, and great care should be taken not to allow any water to get upon the commutator, armature or field coils, as it might short-circuit or ground them. If the bearing is very hot, the shaft should be kept revolving slowly, as it might stick to bearing, if stopped. Heating of bearings is due to a lack of oil, shaft rough, grit or other foreign matter in bearings, shaft and journal too tight, shaft sprung, or bearings out of line, too great a load on belt, or bearings heated by hot armature, commutator or pulley. A rough shaft should be turned to smoothness in a lathe and the bearing fitted to the new diameter. It is very difficult to straighten a bent shaft; it might be bent back or turned true, however, but usually a new shaft will be necessary. In lining up bearings by either raising or lowering the bearing on its seat, or by moving it sideways, it is well to note that an even air gap must be maintained at all times, to avoid any trouble due to an unequalized magnetic pull on the armature. If there is too great a load or strain on belt, which would cause heating of bearings, reduce the belt tension or use larger pulleys and lighter belt, so as to relieve the side strain on the shaft. The slipping of the belt on the pulley may heat one or both bearings.

Noisy operation may arise from the pulley or armature being out of balance, a shoulder on the shaft or the shaft collar striking against the bearing, chattering of the brushes, and so on. These causes may be discovered, as a rule, without great difficulty.

Operating at wrong speed is generally a serious matter in an establishment where reliable speeds are essential. The speed may be either too low or too high. A low speed may come from either a low voltage, overload, short-circuit or ground in armature or shaft tight in bearings. A high speed may result from either a weak magnetic field or voltage too high. Any of these faults can be easily remedied by adjusting the voltage, field or load to the name-plate rating. A short-circuited armature coil is often caused by a piece of solder or other metal getting between the commutator bars or their connections with the armature. If the short-circuit is within the coil itself, the only effective remedy is to rewind the coil.

When a motor fails to start, the trouble is generally outside the motor itself. The trouble usually is an open circuit somewhere, or else the machine is not properly connected to the line.

Chicago Members of National Electrical Contractors' Association to Hold Meeting.

Local members of the National Electrical Contractors Association will hold an important meeting in the Kuntz-Remmler restaurant, Chicago, on May 15. This will be the second meeting of the kind held here within the past few months. The object of these meetings is bring the contractors in and around Chicago together in a social way and to afford opportunity for free and full discussion of matters concerning electrical contracting. They partake largely of the nature of "experience meetings." The approaching meeting is expected to be an unusually important and interesting one.

Wages of Electricians in Indianapolis.

The electrical workers of Indianapolis, Ind., have entered into a definite contract with the electrical contractors of that city in the matter of wages. Electrician's wages will be increased from 42.5 cents an hour to 45 cents. After one year the pay will be further increased to 47.5 cents, and at the end of the second year there will be still another raise to 50 cents an hour.

A recent number of *Electrical Industries* tells of an injunction brought by an electrical contractor in England to restrain the Town Council in his town from trading in wiring and electrical fittings. A temporary restraining order has been granted by the court, pending the final hearing.

M. N. Murphy.

Of the younger men in the field of electrical construction there are very few who have had wider experience in construction work or who are better and more favorably known than M. N. Murphy, of Omaha. He has been engaged in electrical work continuously for twelve years now, never having been interested in any other vocation since he became old enough to earn a livelihood for himself, and during this period he has always held positions of importance and responsibility.

Mr. Murphy was born in 1878, in Chicago. Having obtained a preparatory education in the schools of that city, he entered the University of Wisconsin in 1897. He was graduated in electrical engineering from that university in June, 1901. He immediately secured a position as electrical engineer with the George A Fuller Construction Company, in New York City, and was assigned to the department of electrical construction

M. N. Murphy,
Mid-West Electric Company.

maintained by that organization. He held this place for two years, and the large electrical installations which he had charge of while there included the Flat-Iron Building, the R. H. Macey department store building, the New Amsterdam Theatre, the Hotel Astor and the Hotel Belmont buildings, and the Metropolitan and Union Club buildings.

In 1903 Mr. Murphy was tendered and accepted a position as engineer with the Western Electric Company. After two years with this company, he resigned to become electrical engineer for Marshall Field & Company, in Chicago. Very soon thereafter he was offered a more lucrative position as estimator for one of the largest electrical-contracting concerns in the city just mentioned and decided to accept the place. His work here attracted the attention of the Johnston Electric Company, of Omaha, and four years ago this company secured him for the position of superintendent of electrical construction, in which capacity he is still serving.

It should be noted in passing that the Johnston Electric Company has lately become the Mid-West Electric Company. It conducts one of the largest electrical supply houses west of Chicago, and its contracting business is not second to its supply business. In addition to big jobs of electrical construction in the city of Omaha itself, the company is continually engaged in work of this kind in other parts of Nebraska and in Wyoming, Kansas, Iowa and other neighboring states. The company's success along construction lines is in no small measure due to Mr. Murphy's skill.

Mr. Murphy is an enthusiastic Jovian. He is married and his home is at 5110 Webster Street, Omaha.

Among the Contractors.

The L. G. Robbins Electric Company of 67 East First South street, Salt Lake City, Utah, has just completed the installation of the electrical work on the new Hawthorne school, including the necessary fixtures. The company greatly increased its store space, at its present address, about May 1.

The Le Bron Electrical Works, of Omaha, has recently installed the equipment for electric drive in the plant of the National Box & Lumber Company, in the city mentioned. The installation included 25 motors ranging in capacity from 30 horsepower down. The National Box & Lumber Company buys current from the Omaha Electric Light & Power Company.

An electrical contractors' association has recently been formed in Salt Lake City, Utah, of which E. H. Eardley has been chosen president and G. J. C. Guiver, secretary. The association embraces practically all of the electrical contractors of that city. Weekly luncheon meetings are held

Judson McFell, president of the McFell Electric Company, of Chicago, has perfected an invention of his which provides a new system of selectors for train dispatching. Mr. McFell's company, which is one of the large electrical-contracting concerns of Chicago, with a branch office in San Francisco, does considerable work for the railroads running into Chicago, and it was while engaged in this work that Mr. McFell became interested in train dispatching.

This new system of selectors possesses the advantage of having neither electrical contacts nor tension springs, and of requiring no local batteries for its operation. As soon as Mr. McFell returns from a month's visit to his San Francisco office, for which city he will leave in a day or two, the invention will be tried out on the lines of the Illinois Central Railroad.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

A New Kind of Soldering Iron.

I have found the soldering copper illustrated here to have several advantages over the regular straight tool, especially when wire joints near a ceiling have to be soldered. By the use of a tool of the kind illustrated I have saved myself from many a burn which would have been inflicted by falling pieces of hot solder if a straight soldering iron had been employed.

In making this tool I took an ordinary straight iron and removed the copper portion from the stem. I then drilled a hole through the copper as indicated, making

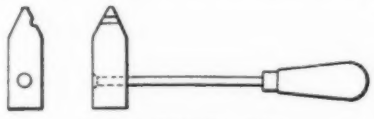


Fig. 1.—Soldering Iron.

the hole slightly smaller than the rod to be inserted. The rod was then filed to a slight taper, driven through the hole and riveted on the end. Then I filed a groove crosswise in the copper near pointed portion, the purpose of this groove being to hold the melted solder, which otherwise would have a tendency to roll off as fast as applied.

In using this soldering iron the groove is filled with solder and held parallel with the wires to be soldered. Thus the hands are kept well out of the way of any metal that may fall.

This iron can be used rather conveniently as a hammer also when a better hammer is not at hand.

Henri Piccard.

Removing Floor Boards.

Knowing how difficult the average electrical worker finds it to take up boards in installing concealed wiring, and in what poor condition the floor is sometimes left when the job is done, I venture to describe my way of going at this task in the hope that what I have to say may contain a helpful suggestion. I have found the following the best way to go at the job in question.

Make a small opening in the crack between the two boards, where the pocket is to be, with a chisel, and saw along this crack with a compass saw, cutting through the tongue of the board, or through both boards if it is a double floor, until you feel the saw strike a beam. Then, starting at the same point as before, saw in the opposite direction until another beam is encountered. Now saw across the board along the side of the beam, using a mitre saw for the purpose. Do not make a hole to start the saw; the tip of the saw itself may be used for this purpose. When the board has been sawed across at both of the two beams referred to, it may be removed readily enough without any breaking whatsoever.

Before replacing the board, nail a cleat on the upper edge of each beam in order to support the piece which was taken out. In this way a pocket can be opened and closed up again with practically no injury to the floor.

Henri Piccard.

Removing "Knockouts."

It often happens that electricians destroy outlet boxes unnecessarily in removing knockouts. The electrician

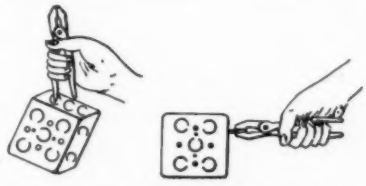


Fig. 2.—Removing Knockouts with Pliers.

loses patience with a refractory knockout and tries to smash it out with heavy blows with a hammer; and he thus knocks the box out of shape.

I have found the method of removing knockouts indicated in the accompanying figure the best way to get them out. It prevents the wanton extravagance referred to above. Hit the plug with the handle of your pliers, and then give it a twist with the jaws of your pliers, in the way shown in the right-hand side of the figure. It will generally come out easily enough.

In order to save time and trouble for his men and to insure neat jobs, a contractor should always order outlet boxes which have the plugs cut all the way around, except for a small neck on one side; instead of the "cut-out and wedged in" kind, in removing which a rivet breaker has to be employed.

W. L. Dimelow.

Pulling Additional Wires Into Conduit.

Other wiremen as well as myself often come across conduits that already have circuits in them, and want to pull in another circuit—or sometimes want to pull in a third wire for a switch. The easiest way I have found is to splice two wires on one of those already in and use that for a fish wire to pull the otner two in.

If the conduit is not already too full, three wires may be pulled in at a time in this way, provided so many are needed.

Arthur A. Reeve.

Dipping Lamps.

When I went to dip some incandescent lamps not long ago I found that the blue color which we were going to use, and which we had had on hand for some time, was full of clots and apparently spoiled. I obtained fair results with it, however, by adding denatured alcohol and boiling it in a vessel surrounded with water. During the dipping process I kept the solution warm while waiting for lamps to dry by leaving it in the hot water.

J. Paul Warner.

Taking Up Slack in Exposed Wiring.

The accompanying sketch contains a suggestion which may be of value to the wireman who is without a helper to pull the wires tight while installing cleat or knob-and-tube work. I proceed in such a case by installing the cleats or knobs and placing the wires in them loosely, after which I

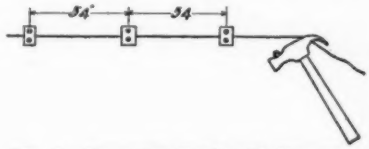


Fig. 3.—Removing Slack with Hammer.

drive a ten-penny nail at a point about six inches beyond the last cleat or knob, and use my hammer in the manner indicated to tighten the wire. I find that by this method I can get a wire as large as a No. 4 tight without harming the insulation.

Walter Hallst.

Repairing Bell Circuit.

While repairing door bells in a large building consisting of a number of flats, I found that there was a break somewhere in the common wire between the battery and the bells in one of the flats. The wiring being concealed, I could not get at the place where the break was, and, it being difficult to run a new wire, I hit upon another idea. I connected one side of the battery to a conduit-pipe nearby and also made connection between the bells and a heating-pipe running near the ceiling a few feet away from the bells. As both pipes were connected with the ground, this restored the connection between the battery and the bells and they rang all right again.

Before grounding one side of a battery in work of this kind, one should make sure that the wires connected to the other side are not already grounded.

C. M. Frykman.

Among the Supply Men

One of the pioneer electrical supply houses in this country is the Burgess-Granden Company of Omaha, Neb. This business was established in 1878, and reorganized in 1905. The officers of the corporation are W. L. Burgess, president; Charles A. Granden, vice-president; George H. Graham, secretary and treasurer. About half of this company's business is of a retail nature, the other half being devoted to jobbing and manufacturing. Each department is maintained distinctively, and the selling organization covers western Iowa and Nebraska.

The retail business of the Varney Electrical Supply Company, Indjanapolis, Ind., amounts to about $50,000 a year. The company does not, however, make a special feature of its retail business. This business was established in April, 1900, and the selling organization covers Indiana, eastern Ohio, and Illinois.

The Avery-Loeb Electric Company, Columbus, O., is one of the most enterprising supply houses in the country. This company believes in the value of good publicity, and its price lists and timely bulletins might well be emulated by others in the industry. About one-tenth of its total sales are along retail lines, about half of this to electrical contractors and dealers. The company features something special in theater programs each week, and sends out its circular letters and special literature every two weeks, featuring some new device. Circulars and cards are sent to the entire trade once a month. The company keeps two city men busy, and covers a very popular and profitable territory within a radius of sixty miles of Columbus. It has two men on the road all the time, and the officers make weekly trips covering each part of their territory. The company holds a salesmen's meeting every Friday night, and every two weeks a factory representative talks of his line to the company's salesmen. The business was established January 9, 1911, and the officers of the company are Oscar Avery, president; A. E. Loeb, vice-president; C. W. Hammond, secretary-treasurer. C. S. Campbell is the selling agent of the company. The company has a fine store and display room at 114-116 North Third Street.

The George Worthington Company, Cleveland, O., is conducting a special campaign on Hot-Point heating appliances. This company's business is mostly wholesale, but it does a retail business to a small extent. Business is pretty good in Ohio and Indiana, although the company is not experiencing any very special demands. The electrical department was established in 1902.

The Smith-Perry Electric Company has succeeded to the business of the Central Telephone & Electric Company, of Dallas, Tex. The company carries an extensive list of standard electrical material. Royal Smith is president of the company, and H. H. Perry is secretary and treasurer.

Albert Smith, Incorporated, Milwaukee, Wis., is the name of the organization of men that is continuing the business of the late Albert Smith. The president of the company is Christian J. Litscher, of Grand Rapids, Mich. Mr. Litscher has been a successful jobber in Grand Rapids for many years, and looking for a broader field organized the Milwaukee company. He is not at present active in Milwaukee, but devotes one or two days every week to seeing that things are moving right, and will probably later on make his headquarters there. The vice-president is E. A. Quarfot, of Chicago, Ill., and Wisconsin. "Ernie," as he is familiarly known to the trade, has the responsibility of taking care of the out-of-town business. H. F. Boggis, general manager, was for the past three years manager for Mr. Smith, and was for 23 years with the Milwaukee Electric Railway & Light Company. C. S. Worden is secretary of the company. The selling organization covers Wisconsin, Northern Illinois and Iowa.

J. C. Davidson, manager of the electrical supply department of The Hendrie & Bolthoff Manufacturing & Supply Company, Denver, Colo., will attend the convention of the Electrical Supply Jobbers' Association at Atlantic City. This company does some retail business, but its operations are principally of a wholesale character. The selling organization covers Colorado, New Mexico, Wyoming, Utah, part of Nebraska and Kansas.

The Monarch Electric Company, Kansas City, Mo., will hold its semi-annual sales conference on June 1. This business was established in 1898, covering Missouri, Kansas, Oklahoma, Nebraska and Arkansas.

The St. Paul Electric Company, St. Paul, Minn., operating in Minnesota, North and South Dakota, and part of Wisconsin, reports present demands for material in small lots and a promising outlook for the near future. This business was established in 1897. B. B. Downs is president of the company, and S. B. Howarth is vice-president and acting treasurer.

The Pacific States Electric Company has a salesmen's dinner once a month at each branch, and a general convention once a year. The business was established in 1909, and the offices and warerooms are located in San Francisco, Los Angeles and Oakland, Cal., and at Portland, Ore. The company's business is principally of a wholesale nature. The selling organization covers Arizona, California, a portion of New Mexico, Nevada, Oregon, Washington, a portion of Idaho, Alaska, Hawaii, and the Pacific Coast from Mexico to British Columbia. H. V. Carter is president of the company.

The Boss Electric Supply Company, Providence, R. I., reports activity in illumination specialties. This company was established in 1910 by F. A. Boss, proprietor of the company. The selling organization covers Rhode Island, southern Massachusetts and eastern Connecticut.

Ed. N. Watkins, proprietor of the Home Electric Company of Tacoma, Wash., has had a unique experience in the electrical business. Mr. Watkins was born and raised in West Virginia, and became an electrician while in his teens. He moved to North Dakota while still a very young man, and for three years was engaged in the electrical business as an em-

ployee. From North Dakota, Mr. Watkins was attracted to the Pacific Northwest, and with Mrs. Watkins moved to Seattle. He could not establish a connection in Seattle, and sixty days found him pretty near the limit of his resources. He found an opportunity of securing employment with the Davies Electric Corporation, of Tacoma, as a solicitor, and started to work. This company failed, and Mr. Watkins with a fellow employee got a little fund together and started a small contracting business of their own. Three months later he bought out his partner's interest and launched into a general electrical jobbing business in Tacoma, giving this city its first exclusive jobbing house in this line. He became one of the Westinghouse jobbers, and made good from the start. After eighteen months in the store at 943 Commerce Street, the business had grown to such an extent that he was forced to seek larger quarters. In March of this year he secured the entire stock of the Tacoma General Electric Company, selling this off in a remarkably short time. Last year he secured the contract for the city of Tacoma to furnish lamps, and his company also furnishes meters, transformers and wire for the city. Mr. Watkins expects to break into the Alaska trade this summer.

The Eaton-Chase Company, Norwich, Conn., reports business quiet with an outlook for improved conditions due to a general picking up of activities in eastern Connecticut. About one-third of this company's electrical sales are retail. Both the wholesale and retail departments are handled together. This company was organized as a partnership in 1864 and conducted a general store. The business was afterward restricted to hardware, and for 20 years has had an electrical contracting and wholesale department.

The Columbian Electric Company, St. Joseph, Mo., reports a very healthy outlook and is experiencing at the present time a good demand in the independent telephone field, and for the extension of high-voltage transmission lines for power and lighting. The business was established as a corporation in 1893. The officers are W. R. Thomas, president; Jacobson Gieger, treasurer; T. O. Strong, secretary. The company carries a small retail department in connection with its wholesale business. The selling organization covers Missouri, Kansas, Nebraska, Iowa, South Dakota, eastern Colorado, southern Wyoming and Oklahoma.

Legal Notes

THE RULES REGULATING THE RATES FOR SERVICE.

By Maguire and Mooney.

In states where the regulation of rates has not been relegated to a public-utility commission, municipalities will have regulatory powers only when expressly conferred by the Legislature. The question of fixing rates, including the imposition of a minimum charge, should be definitely settled in the franchise. The courts will interfere only when the utility company can show that the prescribed rates are confiscatory, or the consumer can show that his rights have been infringed.

While the rates of electric companies may be regulated by municipalities, yet those municipalities have neither right nor power to regulate rates unless the State has delegated that power to them. And, in the absence of express or necessarily implied authority from the Legislature, a municipality has no power, at least in the absence of contract, to regulate the rates to be charged by public-service companies.

A number of states provide for a commission that has the power, after examination and consideration, of regulating the rates of the various public-service companies. To the modern mind this is a simple solution of a rather perplexing question. When a public-service corporation is operating in several cities and each city has the right to regulate the rates to be charged, it can be seen that there are hardships put upon that company by the conflicting rates. Furthermore, the body that governs and controls the regulation of rates in a municipality is the Board of Aldermen or some similar body, generally composed of men of no apparent brilliancy, yet without even due consideration or deliberation they often attempt to fix the rate of public-service companies much below that which service could be given for. Reduction of rates is often a campaign plea, for the purpose of securing a large vote. It was for reasons of this kind that commissions have been formed to regulate the prices of electricity, gas, and the other services to the public. A body of this kind acts impartially with due regard for the interests of the company and its stockholders, as well for the interests of the public.

The one matter that public-service companies have to continually protect themselves against is the unwarranted acts of municipalities in seeking to reduce rates to sometimes an absurd point. For this reason it is well to consider the rights of both the municipality and the public-service company. Inasmuch as these questions have arisen most frequently in cases concerning gas companies it is necessary, in the absence of good electrical cases, to study the rules regulating other public-service companies.

The right to regulate and fix rates which a public-service corporation may charge for its services to the public is a legislative, and not a judicial, function. The judiciary has no power to fix the rates to be charged by these companies. The only interest a court may have in the fixing of rates is to be positive that the rates as fixed by the law are fair and just. If the rates prescribed are too low to compensate for the service rendered, an enforcement of them would result in taking property employed in the business for a public use without just compensation. The propriety of such legislation must be judicially determined under the constitutional guaranties that "the property of no person shall be taken for public use without just compensation," and that no one shall be deprived of his property without due process of law.

At the time the franchise is granted to the public-service company the matter is generally determined. This authority is vested in the municipality,

in lieu of commissions, provided that the municipality under the law has authority to do this. A municipality has implied power to fix the rates at which electric current is to be sold if it is vested with the power to otherwise regulate these companies.

Henry Boerth kept a restaurant in the city of Detroit. In October, 1901, he used for fuel purposes in said restaurant a large amount of gas. The Detroit City Gas Company presented its bill on the basis of 80 cents per 1,000 feet, and Boerth tendered them a sum at the rate of 60 cents per 1,000 feet. This tender was refused and the company threatened to discontinue Boerth's supply of gas. Thereupon he instituted suit, contending that the rate charged was both unreasonable and unjust discrimination. He was not permitted to introduce any evidence tending to prove the rates unreasonable, because, by franchise or contract, the city had permitted the company to charge 80 cents per 1,000 feet for gas. On this point Boerth appealed, and set up the further point that the company supplied gas for power purposes to those who used gas engines at the rate of 60 cents per 1,000 feet, and that this was unjust discrimination. The court held that in order to safeguard the rights of the city's inhabitants who use gas or electricity, it is not only reasonable that the city should have the power to fix the rates, but that it was highly expedient and necessary that it should possess this power. The company charged those who used gas for illuminating purposes 90 cents; those who used it for fuel purposes 80 cents; and those who used it for power purposes 60 cents. The court, in this particular, held that unless the law gave the company the right to arrange its schedule of rates in this maner it could not do so. While the reason under which this was conceived is very good, nevertheless, unless this power is actually given to the company it cannot be exercised. But the company, in this case, did have the power to discriminate, and knowing that those who used gas for power purposes used on an average much more than those who used it for fuel or merely as an illuminant, it had a right to discriminate, and Boerth's appeal was dismissed.—Boerth vs. Detroit City Gas Company, 152 Mich., 654.

The limit of the regulation of rates cannot be strictly stated in one rule but arises more aptly when applied to a set of facts. A state or a municipality cannot, under the guise of a regulation, bring about the destruction and confiscation of the property of a corporation. Nor can it so hamper a company, by enforcing inadequate rates, to a point where the stockholders receive small or no dividends. Of course, the public-service company must be economically and properly managed, because it will not be permitted to defend against a lower schedule of rates unless it shows or is capable of showing that if the company would operate scientifically and economically it could not make a profit under the new rates. This rule is reasonable, because where the public is concerned, a public-service company should not be permitted to take advantage of its bad business methods or extravagant management.

The true and best test of the validity of rates is their reasonableness. If rates afford some compensation, even though small, they cannot be held insufficient by a court, but they must afford some dividend to the stockholders after the payment of fixed charges and costs of service. And the justice of a law limiting rates must be determined with reference to its effect upon the whole class of electric service companies, and not with reference to its effect on one particular company. It may readily be seen that rates that would not affect one company might, under different circumstances, bankrupt another. Accordingly, because a certain rate is entirely adequate for one company, it is no indication whatever that that same rate will apply to any other company. The reasonableness of the schedules of rates is to be determined by the facts in the case itself and not by comparison with rates permitted other companies at other times and places. A company generating electricity through the agency of water power can give the public lower rates than one employing steam power, and a company that has a large number of customers situated closely together can give lower rates than a company that has not so many customers and these not situated close together.

A rate which would result in forcing an individual or corporation engaged in a business of public utility into insolvency would be depriving him or it of property without just compensation and without due process of law. Outside of the company, both the municipality and the individual consumers have an interest in the rates. After the municipality has passed its ordinance it is the duty of the company to accept or reject the ordinance or franchise. Thereafter the only person that may object is the individual consumer. New York is the only state that holds that the consumer has no constitutional rights that can be invaded by even an unreasonable rate. They reason that the consumer is under no obligation to purchase electric current, but that the company is bound to furnish. The other states have declared the rule to be that the reasonableness of the rate is always a question for the court; and, although the price of gas is fixed by the Legislature, the consumer, as well as the manufacturer, may question the reasonableness in the courts.

The rates prescribed by ordinance are always presumed to be reasonable, and if they are too low the company must show wherein they are too low, and if they are too high the consumer must show the excessiveness.

There is another phase to the rate question that is important. Has an electric company, whose rates are fixed by public authorities, the right to establish a minimum charge? This question, to be satisfactorily answered, depends entirely upon the franchise of the company. If that franchise permits it to establish a minimum charge, it has a right to so establish it. But frequently the franchise does not provide for anything of the kind. In Montgomery Light & Power Company vs. Watts, 51 So., 726, the ordinance granting the franchise contained no provision permitting it to fix a minimum rate or charge "meter rental." The company, nevertheless, attempted to fix a meter rental for those of its customers who did not consume $1 worth of current during a month. The court, while admitting the justness of such a practice of charging a meter rental where the amount of current consumed was so small as to render it unreasonable that the company should be required to furnish a meter and keep up service for so small an amount of business, held that the ordinance was the contract between the parties and that the court could not read provisions into it that it did not contain, and accordingly said the company could not fix a minimum charge. However, under this same sort of facts, a person who is using gas and does not propose to use electricity, could not insist that an electric company place a meter in his house merely to provide against accidents, because such a person could not maintain the proper action against the company unless he tendered a reasonable sum for the use of the meter, and for the installation and upkeep.

Northwest Station to be Discussed by Chicago Electrical Engineers.

The next joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, will be held on the evening of Monday, May 27, at which time it is expected that W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, will present an illustrated paper on the new Northwestern Station of that company in Chicago.

Public Service Commissions

WASHINGTON.

On April 24 the Public Service Commission handed down orders in two cases involving connections and through service between different telephone companies. The Pacific Telephone & Telegraph Company operates most of the long-distance lines in the State and had contracts with exclusive traffic provisions with the Benton County Independent Telephone Company and the Yakima Valley Telephone Company. The Sunnyside Telephone Company operates in territory which is coincident with that of the Yakima Valley Telephone Company, and entirely different territory from the Benton County Independent Telephone Company. Complaints had been made by the customers of the Sunnyside Telephone Company because they were unable to secure through connections to territory served by the other companies. The Commission has ordered the Pacific Telephone & Telegraph Company to make connection with the Sunnyside Telephone Company at Sunnyside for through service and for the Benton County Independent Telephone Company to make connection with the Sunnyside Telephone Company at Grand View. Thirty days are allowed in each case for the connection to be made, and it is stipulated that joint rates be established by the companies for through service.

The Commission has suspended the increases in the schedules for toll rates of the Pacific Telephone & Telegraph Company which has been filed to go into effect May 2 between Seattle and Tacoma and numerous other places in the State. The Company is required to show the reasonableness and merits of the new schedules.

On May 2 the Commission promulgated rules for the regulation of gas, electric and water service. These rules apply principally to the metering of the supply. The general rules provide for the appointment of inspectors by the Commission to supervise tests of meters, and require that after testing by the company meters they shall bear a tag or label giving number and size of meter, and date and result of test. The utility company is required to test a meter upon complaint of a consumer within ten days free of charge, providing that such requests are not made more frequently than once in 12 months. Should the company refuse to make such a test, or the consumer not be satisfied therewith, he may make formal application to the Commission which will cause a test to be made by its own inspector. The fee for such tests shall be $3.00, and is to be paid by the consumer if the meter is found to be within the allowed limits of tolerance, or to be slow, and by the company if the meter is found to be fast beyond the allowable limit. A record of all tests must be made by the company and be accessible to the public. Meter readers must, upon request by a consumer, leave a card showing result of reading and time when made. Companies may require a deposit before service is supplied and must pay eight per cent interest upon such deposit, but no rental can be charged for a meter. Companies are required to keep a record of all interruptions of service and of all complaints made by consumers. Other special rules are stipulated for gas, electric and water service. Rule 23 to 27, applying to electric service, stipulate that companies shall provide themselves with suitable equipment for testing and shall employ methods approved by the Commission. Every meter shall be tested and adjusted prior to its initial installation, and shall be tested at least once every two years thereafter at one-tenth load and full load. No meter shall be permitted to remain in service which registers upon no load, or which shows an error greater than four per cent on one-tenth load or full load.

NEW YORK.

For the first time in its history the Public Service Commission for the First District has gone into court to ask for a writ of mandamus to compel obedience to its orders. The case was that of the Bridge Operating Company, which the Commission recently ordered to reduce its rates of fare for local transportation over the Williamsburg Bridge. This company, under a contract with the City, made by the Bridge Commissioner in 1904, is charging three cents for a single ride over the bridge and five cents for two rides. Its reports to the Commission showed that for the last two years, on a capital of $100,000, it had been earning 112 per cent. After public hearings the Commission issued an order directing the company to reduce its charges to two cents for a single fare or three tickets for five cents. The company notified the Commission that it would not obey the order, and asked for a rehearing. The Commission denied the rehearing, and directed its counsel to apply to the Supreme Court for a writ of mandamus to compel obedience to the order. Application was made to the Supreme Court in Brooklyn and the case will soon be heard.

The Public Service Commission, Second District, has made an order requiring the Oswego River Power Transmission Company to show cause before the Commission at Albany on May 27 why it should not direct its counsel to commence an action or proceeding in the Supreme Court in the name of the Commission for the purpose of having the company prevented by a mandamus or injunction from transmitting electricity over and across public streets and selling and furnishing same to persons and corporations in the city of Fulton without the permission, consent or approval of the Commission. On March 18, 1911, the Commission denied the application of the Oswego River Power Transmission Company to exercise franchises in the city of Fulton and the Fulton Light, Heat and Power Company, which now serves that community, has complained to the Commission that the Oswego River Company is actually transmitting electricity and furnishing same to persons and corporations, and has asked the Commission to enjoin that company from doing business in Fulton and that the company be required to remove its poles, wires and electrical construction from the city streets and public places.

The Commission has authorized the Watertown Light, Heat and Power Company to exercise a franchise granted by the village of Glen Park, Jefferson County, for the furnishing of electricity for light, heat and power to that village. It has authorized the Red Hook Light and Power Company to exercise franchises for the furnishing of electricity for light, heat and power in the towns of Milan and Pine Plains, Dutchess County.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No 61.—Opening Exposition From a Long Distance.—After reading that a prominent man had started the wheels of an exposition by pressing a button over 1,400 miles away, I had a dispute with a man who asserted these stories are pure fakes, and that he did not believe it was possible and knew at least one case where merely a telegraphic signal to the operator in a substation had been sent. I contended that a telegraph relay can easily be arranged to control the necessary switches. Was I right?—H. B. D., Faribault, Minn.

No. 64.—Effect of Sagging Tungsten Filament.—If a wire-type tungsten lamp is hung at an angle so that the filament sags after being heated, does the permanent set thereby produced render the filament more fragile than if it had been hung vertical?—P. H. E., Dixon, Ill.

No. 66 Phantom Circuit in Telephony.—It is good practice to use phantom circuits in telephony. If so, what are the limits of this use? What is necessary for the construction of a phantom circuit and how it is done?—N. O. M., Blacksburg, Va.

Answers.

No. 52.—Electric Level Indicator for Tanks.—Is there an electrical device for indicating at a remote point the varying height of water in a ten-foot tank?—J. A. S., Montreal, Can

[Five answers to this question have already been published in the issues of March 30, April 13 and April 27.]

Solution 6.—The solutions heretofore given to this question all seem to be more or less complicated. I think the following is the simplest scheme of all. Suspend a German-silver resistance wire from the top to the bottom of the tank, and connect it to one lead of the circuit. The other lead is attached to a metal plate placed in the bottom of the tank. Both of these are insulated from the walls of the tank. A push button, battery and ammeter are connected to the lead wires in series. As the resistance, and therefore the current, of the circuit varies according to the amount of the wire immersed in the water, the reading of the ammeter is an indication of the depth of the water.—A. L., New London, Conn.

No. 57.—Operation of Moving-Picture Machines.—I understand that moving-picture machines are always run by hand and that motor drive is not permitted. Why is this? Would not a motor drive give a much more uniform speed and therefore produce a more regular and pleasing show?—H. V. N., Columbus, O.

[Four answers to this question have already been published in the issue of April 27.]

This is a question which used to bother the writer a great deal and led him to devise numerous schemes to dispense with the manual operation of moving-picture machines. All of these devices were, of course, objected to by the underwriters. Without doubt, a motor of the proper kind would give the machine a pleasing uniform motion and a wide range of speed. It would also make the work of the operator very much more agreeable. Now, that last word, I believe, is the key to the underwriters' objection. It would make the work so "agreeable" that the operator, if inclined to be sociable, might start his machine and engage in conversation with some one, or, if industrious, he might sort out lantern slides, repair or rewind films, or otherwise occupy his time while he should be giving his whole attention to the machine. He might forget that things happen very quickly when an arc, a powerful condensing lens, and a film as inflammable as gun-powder get mixed up. While the jurisdiction of the underwriters extends only to the protection of buildings and furnishings, a theater or moving-picture show fire is so often accompanied by a frightful loss of life that they feel a double responsibility. It is a very commendable thing that they compel a strict obedience to a rule that will cause the operator to keep his hand and attention right on the machine all the time that the film is in it. The synchronism of the picture might be a little bit off, but the audience is more safe, as well as the operator and the building.—R. W. E., Chillicothe, Ohio.

It is true that a motor-driven picture machine will give a steadier picture than a hand-driven machine, but most operators when "given an inch will take a mile." This is the direct cause of city ordinances against motor-driven machines. It has been my experience a great many times to see operators of motor-driven machines either reading or in the ticket office entertaining the cashier while their machines are running, thus greatly increasing the risk of an already hazardous position. However, not all cities have as yet prohibited motors for this purpose.—O. L., Decatur, Ill.

The principal reason that moving-picture machines are required to be run by hand is that the operator is in constant attendance. In San Francisco and a few other cities the officials will now allow motor drive, as the machines are being perfected with numerous safety devices which protect the film in case of breakage and other troubles.—C. T. P., San Francisco, Cal.

I understand that it has not been possible to secure a film cutout which is entirely successful. This cutout must be so made that it will short-circuit the lamp in case it is defective or all the other lamps on that circuit would not burn. In multiple operation this is not required.—F. D. K., Schenectady, N. Y.

No. 59.—Depreciation of Storage Battery After Idleness.—On starting to use my storage battery this spring, after it was idle all winter, I find that its capacity is much reduced. I can get only about 95 ampere-hours out of it now compared to 115 to 120 last fall. The battery was fully charged and carefully covered before being left. It was purchased two years ago and after the first winter did not show any appreciable decrease in capacity. What caused the decrease which occurred last winter?—R. C., Belvidere, Ill.

As I understand question No. 59, the battery was fully charged and left without further change for several months. Storage batteries thus left charged gradually become discharged through leakage and local action and sulphation generally results. Sulphation clogs up the pores of the lead sponge and peroxide causes loss of active material and forms a non-conducting layer between the active material and the grid. This results in decrease of capacity, increase of internal resistance and reduced efficiency. Repeated overcharges will help to restore the battery, but if it has been bady sulphated it may never regain its former capacity. If a storage battery is not to be used for a considerable length of time, it should either be given a light refreshening charge every two or three weeks, or else be taken completely out of service. The latter can be satisfactorily accomplished as follows: After thoroughly charging the battery, siphone off the acid and immediately refill the jars with clear water. Discharge the battery at normal rate through a resistance until each cell shows a voltage of less than one volt; then remove the plates and allow them to dry. The acid can be stored and used again when the battery is put back into service.—E. C. B., Brooklyn, N. Y.

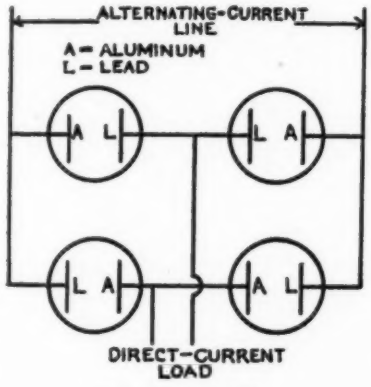
No. 62.—Searchlights as Aids to Navigation.—In view of the great interest in marine affairs aroused by the disaster to the *Titanic*, I take the liberty of asking the following questions: Is there anything in the argument that the use of a searchligh on a steamer prevents the lookout from seeing the lights of a distant vessel? How far may the beam of a reasonably powerful searchlight be seen on a clear night? On a foggy night? Would not an iceberg loom up very conspicuously at a distance of several miles

even on a fairly clear night? What is the power consumption of searchlights such as are used on battleships and large excursion steamers?—J. S. N., Muskegon, Mich.

From my experience a searchlight would not interfere with a lookout unless the beam was thrown in line with and above the distant lights, so that the lookout would have to look out through the beam. Ordinarily such a beam may be seen for eight or ten miles, but when thrown upon the clouds it can be seen by, and has been used for signaling with, vessels below the horizon.

On a foggy night it cannot be seen at all. When looking directly at the searchlight at a distance of 300 yards only a dull red spot is visible, and not even that much can be seen if the fog is particularly dense.

It would be hard to distinguish an iceberg at any great distance without the aid of a searchlight, but the light ought to show it up at a distance of several miles. A 30-inch searchlight, such as is used on battleships, is fitted with a rheostat, giving a range of from 70 to 90 amperes, direct-current, at 125 volts.—F. H., Prattleboro, Vt.



Electrolytic Rectifier.

No. 63.—Value of Commutator Slotting.—I should like to know whether any of your readers have had experience with slotted commutators on motors exposed to oil, dust or dirt.—R. M., Austin, Tex.

Considerable trouble with several motors having commutators unslotted was caused in a chemical plant by dust and chemical fumes. I tried slotting on one machine with such good results that it was applied to several others. The mica was slotted with a hack-saw blade to a depth of about 0.12 inch. The centrifugal force in the case of a five-horsepower motor running at 800 revolutions per minute seems to be sufficient to keep the slots clear of dust, which in some cases is unusually severe. With turbo-generators, running at 2,400 revolutions per minute my experience with slotted commutators is that there is absolutely no trouble, although sulphuric-acid fumes in the generator room are so bad as to oxidize all bright metal work.—J. A. M., Elizabeth, N. J.

No. 65.—Electrolytic Rectifier.—I want to build an electrolytic rectifier to use on a 100-volt, 60-cycle circuit and to carry about five amperes. What kind and size of plate are best for this purpose? What solution should be used?—A. F. K., Louisville, Ky.

A modified Nodon electrolytic rectifier is shown in the diagram herewith. The solution is a saturated one of ammonia phosphate. One plate in each cell is aluminum; the other is usually lead but sometimes iron or other metal. The efficiency is about 60 per cent, since current and pressure are each reduced about 25 per cent. This rectifier is based on the principle discovered by Buff in 1857, that there is a high resistance to current flow when aluminum is used as an anode, but very little when it is used as a cathode. By the use of ordinary gravity-battery jars, a rectifier connected as shown is good for about five amperes.—W. M. P., Seattle, Wash.

The Inspection of Electrical Machinery.

Although the number of fatal accidents from the use of electricity is small, having regard to its innumerable applications, investigation shows that most of those which do occur could be avoided by the adoption of precautions that any electrical expert would regard as reasonable. That they are not adopted is due largely to the belief of many power users that, once installed, an electric motor needs no care or attention beyond the lubrication of the journals, a belief to which support is afforded by their generally good behavior under very adverse conditions. It is unfair, however, to presume too much on such conduct, and a section of power users seem to need educating on this point. This is the more surprising, as the same people would not, as a rule, dream of running their steam boilers or engines without first insuring them against explosion or breakdown to secure the benefit of supervision and periodical examination by engineering experts. Now similar supervision is just as valuable for electrical machinery and as easily obtained, for practically every boiler-insurance company makes the inspection and insurance of electrical machinery a special branch of its buisness. In no industry are the conditions of working of electrical machinery more onerous than in coal mines, where it is so constantly assailed by its worst enemies in the shape of damp, dust, and ill treatment, and, therefore, in no industry is there greater need for independent supervision. This is clearly brought out by Robert Nelson, electrical inspector of mines, in a table appended to his last report setting forth the details and causes of the various electrical fatalities that occurred during 1910. While it may be admitted that much of the electrical plant below ground is not all it might be, and in some cases calls for replacement because actively or potentially dangerous from the point of view of risk of electric shock, a brief study of the statistics shows that a great proportion of the accidents which actually occurred could, as he observes, "have been avoided by systematic and thorough inspection." It is not suggested that those responsible for the upkeep of electrical plants below ground are less conscientious than others occupying similar positions on the surface, but the risk of defects arising owing to the conditions of the service are undoubtedly greater, and the multifarious nature of the duties imposed on those in charge, coupled with the absence of evidence of the positive value of inspecting work when well performed—i. e., when no accidents occur and nothing calls for remark—is likely to lead to lack of appreciation and its concomitant result—indifference. It is easier to assume that everything is right until something goes wrong than it is to be always on the alert against the latter possibility. As specific instances of the result of this attitude, Mr. Nelson mentions the accidents arising from the common failure to protect unarmored cables during shot-firing operations, the casual and inefficient way in which earth connections are often made, and the neglect to periodically test the insulation of apparatus. Each of these causes is directly or indirectly responsible for some of the fatal accidents every year, and is the more to be regretted as it tends to damage electrical development by giving undue weight to the arguments of those who would prohibit its use below ground, notwithstanding its economic advantages and its benefits to the workman by saving him much arduous labor. When inspection, with its accompanying supervision, is exercised by outside independent authorities instead of by the owners' servants, it is almost invariably carried out in a more efficient manner, for the inspector is free from any doubts as to the correct appraisement of his work, which he knows is most efficient when there is least reason for referring to it afterwards.—*Mechanical Engineer.*

Electric Transmission 330 Miles.

A few days ago the Great Falls hydroelectric plant of the Southern Power Company was used to supply electric current to a high-tension circuit 330 miles long. On a test run, power was supplied from Great Falls, N. C., to the cities of Durham and Raleigh.

This is reported to be the world's record in long-distance transmission.

Standard Methods Recommended for Testing Dry Cells.[1]

The methods of testing must in the first place be of benefit to those interested in dry cells, and the users may be divided into three classes: the average ultimate consumer, the large user, and the manufacturer.

No standard methods of testing can be devised, which will be suitable at once for all of these classes, and the most serious obstacles are encountered in formulating methods suitable to the first class. This is unfortunate, since by far the larger proportion of the dry-cell output is so distributed that the user is interested in one, two, six, or perhaps twelve cells as supplying his yearly requirements. This very large number of users should have a test the cost and labor of conducting which should not be out of proportion to the low values of the articles tested. There appears to be no adequate means of meeting this urgent demand for simplicity of equipment and method.

The large users of dry cells, such as telephone exchanges, engine manufacturers, installers of alarm and signal devices, railroads, etc., who purchase cells in large quantities, are especially interested in testing methods. Various methods of testing have been evolved by these users as a basis for purchase specifications and as a means of judging the relative merits of the various makes of cells on the market. To them the matter of elaborateness of tests is of less importance than to the small user.

Of even greater importance is the testing of dry cells by the manufacturer, who must necessarily adopt methods which will give him the necessary information concerning his product, no matter how elaborate.

The methods of testing which the committee is recommending are those which are particularly suited to the second class—the large users. These tests, if extensively adopted, will be of indirect benefit to the small consumer, and will be of mutual advantage to the large users and manufacturers.

It has been suggested to this committee that the methods for testing should include, aside from electrical measurement, methods of physical and chemical analysis, such that judgment may be made thereby of the merits of a cell, and that what constitutes a satisfactory product should be described in these terms so that they might form a basis of specification. There is a striking similarity between the various cells on the market as far as materials used and general structure are concerned. Exceedingly slight variations, however, which introduce large variations in the quality of the product, are not capable of detection by physical and chemical examination, and what is of even greater importance in determining the quality are the methods of assembling, such as methods of mixing, grading as to size of the particles which constitute the cell mixture, and methods of tamping, factors which cannot be easily determined by physical or chemical inspection of the resultant product.

The art of dry-cell manufacture cannot be considered as having been worked out to a finality; improvements are being made and will continue to be made. One maker may discover a simple method of neutralizing the effects of an impurity on his product which may have a detrimental influence in another product, and a judgment based upon the detection of such impurity would thereby work an injustice. The tests, therefore, should be such as determine the ability of the cell to produce results, and these can be determined only by tests involving electrical measurement. The dry cell, in all of its multitudinous uses, is merely a source of electrical energy, and its ability to deliver this energy, in the quantity and at the times desired, constitutes the principal measure of value.

Dry-cell tests may be conveniently divided into three main groups: (1) Tests to determine whether or not a cell is in good condition before being placed in service. (2) Tests to determine the actual or comparative service capacity of cells. (3) Tests to determine the rate of deterioration of cells on open circuit. This classification is followed in this report.

Tests to Determine the Condition of a Cell Before Use.

Electromotive force. — The electromotive force of a cell may be read by connecting a voltmeter directly across the terminals. In new cells of various types the electromotive force may vary from 1.5 to 1.6 volts. If a cell of the type now in general use gives an electromotive force less than 1.45 volts it is an almost certain indication either of serious deterioration due to age, or of the external short-circuiting of the cell, or of some defect such as an internal short-circuit, which will soon render the cell unfit for service. It is seldom necessary to measure the open-circuit voltage of cells, since they are seldom deficient in this respect. It is a test which may be considered as secondary in nature, and should be applied when it is suspected that the cells are below standard, for example, when cells are received with wet packets, when the terminals are corroded, when the electrolyte leaks from under the seal, or when the cells are abnormally low in short-circuit current.

An accurate or carefully calibrated voltmeter should be used, the resistance of which is sufficiently high to render the current flow through it inappreciable. A two-scale Weston instrument of 300 ohms resistance with 3-volt maximum deflection and 1,500 ohms with 15 volts maximum deflection has been found very satisfactory for both cells and batteries. Cheap pocket instruments are often so inaccurate as to make their indications of open-circuit voltage worse than useless. The effect of temperature on electromotive force is very slight.

Short-circuit Current. — The short-circuit current of a cell may be obtained by connecting an ammeter directly across the terminals of the cell. The short-circuit current of a cell is of value only when coupled with a familiarity with the brand of cell in question. If the reading is normal for that brand of cell, it is reasonably certain that the particular cell is in good condition, and that it will probably give as good service as others of the same make. This applies only to cells of the same brand and make. That the short-circuit current of a cell of a new and unfamiliar brand is as high as that of another brand is no indication whatever of the equality of the service capacities of the two cells. The short-circuit current bears no relationship to service, and when measured without reference to temperature or other conditions may be entirely meaningless and misleading.

The ammeter for reading short-circuit current should be deadbeat, and with its leads should have a resistance of 0.01 ohm, to within 0.002 ohm. Two 30-inch lengths of No. 12 lamp cord make very convenient leads. The maximum swing of the needle should be taken as the short-circuit current of the cell. The ammeter should be connected across the brass terminals of the electrodes. Low readings are likely to be obtained if the ammeter is applied to the carbon electrode directly. In order to avoid high contact resistance, the terminals of the cells and of the ammeter leads should be brightened. It has been found very convenient to fit the ammeter leads with small terminals of lead. The contact on the cell terminals is greatly improved, and with such leads it is unnecessary to brighten the contacts. For accurate measurement of the short-circuit current of a new cell, instruments of the pocket type should be avoided. The effect of temperature on the short-circuit current is quite pronounced. The amperage of cells is raised about

1 Portion of a report by the committee on dry-cell tests of the American Electrochemical Society.

one ampere for each 10 degrees centigrade rise in temperature. This value varies considerably with different cells, and is somewhat greater at the lower temperature and less at the higher. At very low temperatures the effect is very pronounced, and it is often noted that cells received in extremely cold weather read but one or two amperes. On bringing them to room temperature however, the short-circuit current becomes normal and the cell is not impaired by the freezing.

Internal Resistance. — This value is usually determined by applying the formula

$$R=(V—V')/C$$

where V is the open-circuit voltage of the cell, V' the closed-circuit voltage, and C the current to which the cell is subjected in order to make the determination. The value obtained varies with the current flowing, the age of the cell, and the temperature.

For these reasons we advise against the use of this test. It indicates nothing in regard to the service capacity, nor does it give an exact value of the actual internal resistance of the cell.

Service Capacity Tests.

In general there are but two reasons for desiring a service test upon dry cells: (1) to ascertain what life may be obtained from a brand of cells in a certain service; (2) to ascertain which one of several brands will give the longest life in that particular service.

With the former object in view the knowledge is best obtained by actual use of the cells in connection with the appliance. In some cases this is one only feasible way in which the definite information sought can be obtained. The great majority of tests are carried on, however, with the second object in view. Where the amount of testing is large, it is impossible, even were it expedient, to use the actual appliances for testing cells, and it becomes necessary to devise special testing methods and apparatus such that results obtained therefrom shall be comparable to the results obtained from the cells when placed in actual service.

It has been suggested that cells of various makes be tested by connecting them in series and discharging them simultaneously through any suitable resistance, thereby assuring that the cells are discharged at the same rate and under identical conditions. There are several objections to this method and we therefore advise against the testing of cells in this manner.

In interpreting the results obtained from a test of various grades of cells, we wish to caution against drawing definite conclusions from the outcome of a single test or of a small number of tests. When the matter of choosing a brand is of much importance, it is necessary to run a series of tests over a period of six months or a year. In this way a very good idea may be obtained of the average service results which may be expected.

Service Tests Recommended.

Telephone Service. — Discharge three cells, connected in series, through 20 ohms resistance for a period of two minutes, each hour, during 24 hours per day and seven days per week, until the closed-circuit voltage of the battery at the end of a period of contact falls to 2.8 volts.

The following readings are taken: (1) Initial open-circuit voltage of the battery. (2) Initial closed-circuit voltage of the battery. (3) Closed-circuit voltage at the end of the first discharge period. (4) Closed-circuit voltage at the end of a discharge period after three days, and weekly thereafter.

Report the results as the number of days during which the closed-circuit voltage remains above the limiting value of 2.8 volts.

Ignition Service.—Discharge six cells connected in series through 16 ohms resistance for two periods of one hour each per day, seven days per week. The periods should be eleven hours apart, but in cases where the circuits are not automatically controlled, the first and the last hour in the working day may be chosen for the discharge periods and the discharge omitted on Sunday, without materially affecting the results.

The following readings are taken: (1) The initial open-circuit voltage and short-circuit current of the battery. (2) The initial closed-circuit or working voltage, and the initial impulse of current which the battery is capable of forcing through a 0.5-ohm coil connected in series with an ammeter, and in parallel with the 16-ohm coil. (3) Closed-circuit voltage and impulse current through the 0.5-ohm coil at the end of the first period of closure, at the end of the sixth period, at the end of the twelfth period and after every twelfth period thereafter.

The test is considered completed when the impulse current at the end of a period falls below four amperes. Report the results as the number of hours of actual discharge to the limiting value of impulse current.

Particular care should be taken to keep the temperature of ignition test batteries as nearly constant as possible, as the service obtainable is greatly influenced by this factor.

Flash-light Batteries.—Discharge the battery to be tested through a resistance of four ohms for every cell in series (eight ohms for a two-cell battery and 12 ohms for a three-cell battery), for a period of five minutes once each day until the closed-circuit voltage at the end of a discharge period falls to 0.75 volt per cell (1.5 volts for a two-cell and 2.25 volts for a three-cell battery).

The following readings are taken: (1) Initial open-circuit voltage and short-circuit current. (2) Intial closed-circuit, or working voltage. (3) Closed-circuit voltage at the end of the first, third and seventh periods of closure, and after each seventh period thereafter.

Report the results as the number of minutes during which the battery was discharged through the resistance to the given end point.

In case the circuits are not operated mechanically, the results are not materially changed if the batteries are discharged only on working days. Four ohms per cell is chosen for the resistance in circuit, since the tungsten bulbs generally used with a three-cell battery have a resistance of approximately 12 ohms.

Miscellaneous Service.—In addition to the telephone and ignition services, which are by far the most important services in which dry cells are used, there are numerous other services, among which may be mentioned the operation of automobile horns, sewing-machine motors, small fans, toys, massage vibrators, cigar lighters, bells, buzzers, etc. In the aggregate these miscellaneous services consume enormous numbers of cells, but they are so numerous, and there are such variable conditions prevailing in each kind of service, that it would be useless to attempt to develop standard tests covering them.

It is not difficult for anyone particularly interested in any special service to arrange a suitable test for himself. Care should be taken to make the conditions of test, viz., number of cells, resistance in circuit, period of drain, etc., approximate those of the service in question.

Rate of Deterioration on Open Circuit.

The voltage and short-circuit current of the cells for test are read initially in order to insure that the cells are in good condition. The cells are then stored in a dry place of normal room temperature.

The following readings are taken: (1) Initial voltage and short-circuit current. (2) Short-circuit current at the end of four weeks, eight weeks and each eight weeks thereafter. (3) Voltage at the end of six months.

The cells are kept on the shelf until the short-circuit current has fallen below 10 amperes. This point is arbitrarily chosen, as it represents a point below which it would be difficult to market the cell. For practical purposes,

the results are expressed as the number of months during which the short-circuit current remains above this cut-off point. Much more meaning, however, is attached to the rate at which the current falls, generally reported as the drop in amperage for a given period expressed as a percentage of the initial amperage. This is especially true when investigation of the quality of cells is the object. For practical purposes, however, the first rating given, i. e., months to 10 amperes, is perhaps preferable.

The results from this test are largely indicative of increase in internal resistance, and bear no definite relation to the service which the cells may give. However, this information, coupled with familiarity with a brand of cells, becomes a very good indication of its quality. It also serves to indicate any serious defects of manufacture.

The ammeter for reading short-circuit current should be deadbeat, and with its leads should have a resistance of 0.01 ohm. Particular attention should be given to the temperature at which cells are stored, as the rate of deterioration is influenced to a marked degree by the temperature of the cells.

The ideal method for an open-circuit deterioration test would be the determination of the decrease of service capacity due to storage over definite periods. This practice, however, would entail much labor and expense where the amount of testing to be done is large.

The Adaptability of Tests to the Needs of Consumers.

The question may arise in the mind of the consumer as to what extent the cells he purchases should be tested. It obviously would not be practical for the small consumer to conduct tests on the same scale as those carried on by a consumer using many barrels of cells per year. It is impossible to formulate any set rules for sampling and testing for any consumer or group of consumers, as the amount of testing done must be regulated by the relation of the cost of testing to the value of the cells purchased. However, we present here suggestions as to the adaptability of these methods to several roughly classified groups of consumers.

The Small User.—In this class may be included the great percentage of consumers. We advise that every cell purchased be read for short-circuit current. Although this reading gives no direct indication of the service capacity of the cell, yet, if the reading is normal for that brand, it may be reasonably certain that the cell is in good condition. It would be impractical for the small user to provide himself with an expensive ammeter, as, for his purpose, a good make of pocket instrument will give readings sufficiently accurate.

The Small Dealer.—This class comprises those dealers who may dispose of from a few hundred to a thousand or more cells per year. The dealer is particularly interested in keeping the quality of his stock up to the standard. As cells are received a representative sample, say 10 per cent chosen at random throughout the lot, should be read with a reliable ammeter. If the readings are normal it would scarcely profit to make any further tests. For his protection all cells should be read with the ammeter before being delivered to customers.

The Jobber.—The jobber buys and sells dry cells largely by barrel lots, and in many cases conducts no tests whatever. If he is desirous of keeping his quality strictly up to standard it would be well to open several barrels in each shipment and test with an ammeter a dozen cells chosen at random throughout the barrel. If the large jobber wishes to carry the best grade of cell for any service, it would probably pay him to conduct the recommended telephone and ignition tests on a small scale.

Telephone Companies. — The small telephone company consuming less than ten barrels of cells per year could install a standard telephone test of small capacity by fitting suitable electrical contacts on a clock and connecting these with a telegraph relay in such a way as to cause the latter to open and close the dry-cell circuits. We would advise that such a test be maintained by each company and that periodical tests (at least four per year) be made on the shipments of cells received and also on small lots of other brands purchased from time to time for the purpose of test. The small company should also test a representative sample (say 10 per cent) of all consignments received with a good ammeter.

The large telephone company using many barrels of cells per year can well afford to install an apparatus for carrying on the test suggested in this report. We would advise that a battery of three cells from each consignment received be placed upon the telephone test. In addition the short-circuit current and open-circuit voltage should be read upon a representative sample of all cells received.

Gas-Engine Manufacturer.—To the gas-engine manufacturer it is important that the batteries furnished with his engine be the best cells obtainable from an ignition standpoint. As the apparatus necessary for carrying on the ignition test is quite inexpensive and as the test requires very little attention, the manufacturer of such engines purchasing a considerable number of cells should conduct the ignition test not only as a check upon the cells he is receiving, but as a basis for judging the merits of the different grades of ingnition cells on the market. An ignition test upon six cells from every fifth barrel received with a maximum of two tests for a single consignment of cells, would probably be sufficient. Before being sent out with an engine the short-circuit current on all cells should be read and those reading abnormally low (5 amperes below the average for the brand and grade) should be rejected.

Copper Production Breaks Record.

The United States Geological Survey has just issued an advance statement of the production of copper in 1911. This statement, prepared by B. S. Butler, gives the final figures of production as made up from reports from all the reduction plants.

The total smelter production from ores mined in the United States was 1,097,232,749 pounds. This is the largest production in the history of the industry and compares favorably with the output of 1,080,159,509 pounds for 1910.

Arizona again heads the list of copper-producing states with a production of 303,202,532 pounds, the largest production ever made by the state. Montana is second, with 271,814,491 pounds.

The total production of refined copper from primary sources, both domestic and foreign, was 1,433,875,025 pounds in 1911, compared with 1,422,039,135 pounds in 1910.

In addition to the copper produced from ore a total of 214,000,000 pounds was recovered by the treatment of old copper and brass, copper and brass scraps, filings, clippings, etc.

The consumption of copper in the United States for 1911 was apparently somewhat smaller than in the previous year, but the amount exported was considerably greater, so that the stocks of refined copper held in the United States were materially reduced.

Engineering Education Meeting.

The annual meeting of the Society for the Promotion of Engineering Education will be held at Boston, Mass., June 26 to 29. There will be a number of sessions devoted to section meetings, at which problems connected with laboratory administration will be discussed. The section on Electrical Laboratories will be in charge of J. O. Phelon, professor at Worcester Polytechnic Institute. The local arrangements for the meeting are in the hands of a committee consisting of Professors Allen, Anthony, Jackson, Marks, Tyler, Williston and Alexander.

DETECTING THE PROXIMITY OF ICEBERGS.

Barnes Resistance-Thermometer Method.

The terrible wreck of the steamer Titanic has called forcible attention to the perils to navigation from icebergs and several schemes for detecting their proximity have been brought forth. One of the most effective seems to be the use of a powerful searchlight, but in dense foggy weather even a strong beam of light becomes rapidly obscured.

Brief reference has been made in the last two issues of an interesting invention along this line by Howard Turner Barnes that was patented in the United States on April 9. The inventor is professor of physics at McGill University, Montreal, Canada. For many years he has made extended studies of ice conditions in navigable waters, some of these investigations having been made for the Canadian Government. As a result of these researches, Professor Barnes came to the firm conviction that an accurate method of measuring sea-water temperatures afforded the most reliable means for detecting the proximity of icebergs and even shoals or other causes of marine disturbance near a vessel. This method is dependable at night as well as by day and in dense fogs as well as in clear weather.

On account of the timely interest in such a method and the practical and scientific reliability thereof, the following description of Professor Barnes's invention is taken substantially in full from the United States patent which has just been granted to him.

It has been theoretically suggested that the presence of icebergs might be detected by their cooling effect on the water, this cooling effect probably being produced by the current of cool and light fresh water running down from the iceberg, and spreading on the surface of the surrounding water. Very little practical use has been made of this suggestion, as navigators are divided in opinion as to its value, owing to the variable results obtained. Any data gathered to test the method have been by means of the ordinary drop bucket and thermometer, which could not read closer than one tenth of a degree. These readings were also taken a considerable distance apart owing to the speed of the ship, and as the temperature of the sea fluctuates indepently of the ice, it will be seen that such readings would be of very little value.

With the method and apparatus here described, it is possible to read accurately temperatures to one thousandth of a degree and to record continually such readings. Experimental data covered by this method and apparatus have revealed a curious and characteristic condition of the sea temperature in the vicinity of an iceberg, which was incapable of observation by the old methods. This is, that on approaching an iceberg, the temperature first slightly rises and then lowers—a characteristic fact which may be taken as an indication of the presence of ice and which can be due, as far as can be seen, to no other cause. The cause of the slight rise in the temperature is not clear—it may be due to temporary reaction at the juncture of the fresh surface current from the iceberg and the sea water—or it may be due to the presence or absence of definite organic life at this juncture. To observe this characteristic effect, it requires two conditions, provided by the present method and apparatus, namely: extremely accurate measurement of the temperature to within one thousandth of a degree, and the continuous recording of the measurement taken.

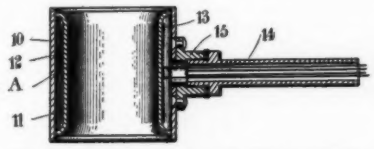


Fig. 2.—Sectional View of Thermometer.

In the practical carrying out of the invention, an electric-resistance thermometer is employed controlled by the sea temperature and connected to a resistance-measuring apparatus which continuously records the fluctuations in resistance and consequently in temperature. A very convenient form of recording mechanism is the Callendar recording combined potentiometer and Wheatstone's bridge, such as manufactured by the Cambridge Scientific Instrument Company, Ltd. To adapt this instrument to sea use, however, it is necessary to replace the suspension galvanometer by a Western portable galvanometer relay or equivalent device which will not be affected by the motion of the ship.

A very convenient arrangement for the detection of icebergs is the provision of two thermometers measuring the temperatures at the surface and lower down, which thermometers may, if desired, be differentially connected so as to measure only differences in temperature. Where a difference in temperature exists between the two thermometers, it may be taken that it is due to some local causes, such as icebergs.

The form of apparatus for carrying out the method is illustrated in the accompanying drawings, in which Fig. 1 is a diagrammatic view of the apparatus; Fig. 2 is a sectional view of a form of thermometer which may be employed; Fig. 3 is a diagrammatic view of the connections when two theromemters are employed.

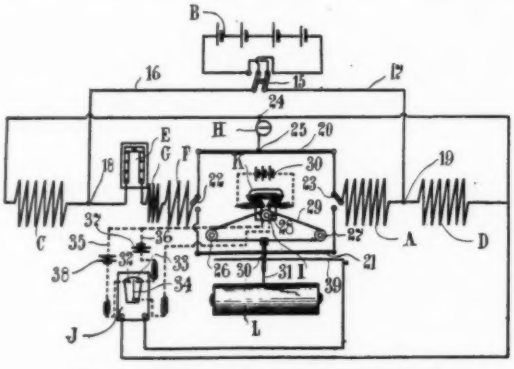


Fig. 1.—Diagrammatic View of Apparatus.

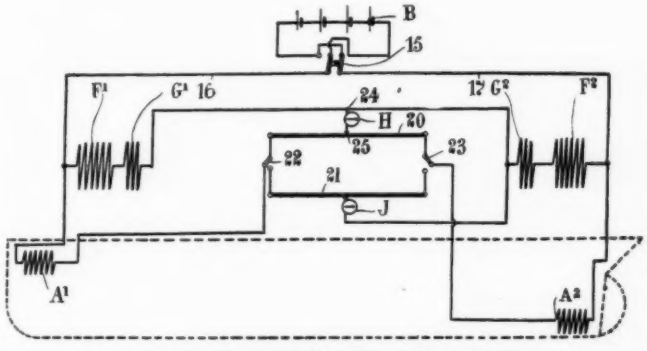


Fig. 3.—Diagrammatic View of Connections.

Referring first to Figs. 1 and 2, *A* represents the thermometer, which is of the electric resistance type. Greater stability in the operation of the thermometer can be secured if the resistance wire is formed of iron instead of the usual platinum. The form of thermometer illustrated is one has been specially designed for the purpose. It includes concentric tubes *10* and *11* of heavy copper, the inner tube being flanged to form a space between, within which the resistance coil *13* of the thermometer is located. This coil is of fairly large resistance in order to render fluctuations

more readily perceptible, 100 ohms being sufficient for this purpose. The connections from the resistance coil lead through a radially extending tube *14* which has screw-threaded engagement with a connecting member *15* secured to the side of the tube *10* opposite an aperture therein. This thermometer is so placed as to be directly affected by sea temperature. For example, it may be trailed through the water at a depth of a few feet below the surface. Otherwise it might be secured to the hull of the vessel below the water line.

Fluctuations in the resistance coil, *A* are accurately measured and continuously recorded by apparatus located on the vessel. The ordinary Wheatstone's bridge method of measuring the resistance has been found to be the most satisfactory. In the diagrammatic connection in Fig. 1, *B* represents the operating battery and *15* a reversing key for the same, from which conductors lead to the junction points *18* and *19* of the resistances forming arms of the bridge. Two bridge wires *20* and *21* are adapted respectively for the observation of a single temperature, and for operation of the continuous recording mechanism, either one or the other of these bridge wires being thrown into circuit by means of switches *22* and *23*. The arms of the Wheatstone bridge are constituted by resistance coils *C* and *D*, each of resistance substantially equal to that of the thermometer coil *A*. The thermometer coil itself forms, with a portion of the bridge wire, the third arm of the bridge, while the fourth arm comprises the remaining portion of the bridge wire, a series of small resistances from one tenth to ten ohms, represented in the form of a resistance box *E*, a compensating wire *F* and a compensating coil *G*. The wire *F* is used to equalize the wire leading to the thermometer, wherever it may be placed, and comprises a loop of wire placed closely to the leads of the thermometer coil *A* and running side by side with them, whereby it will change equally in temperature with these leads, and will therefore change equally in resistance, and, being connected to the opposite arms of the Wheatstone bridge will not affect the balance point. The coil *G* is adapted to equalize the resistance of the thermometer at zero centigrade when contact is made with a suitable point of the scale on either of the bridges. *H* represents a portable galvanometer whose leads connect the junction point *24* with a sliding contact *25* on the bridge wire *20*, the type of galvanometer being such that it will not be affected by the motion of the ship; a Weston portable galvanometer has been found suitable for this purpose.

I represents, as a whole, a continuous recording mechanism for the fluctuations in the resistance, the type of instrument found most convenient for this purpose being Callendar's record, combined potentiometer and Wheatstone bridge type. The instrument is varied, however, by the substitution of a Weston portable galvanometer *J* for the suspension galvanometer and the use of the reversible motor *K*. The recording mechanism includes pulleys *26*, *27* and *28*, over which a thread or cord *29* is stretched, the pulley *28* being adapted to be driven by a reversible motor *K* which has a field separately excited from a battery *30* and has an armature which may be rotated in either direction. The thread or cord *29* carries a sliding contact *30'* mounted on the bridge wire *20* and carrying a pen *31* adapted to make a record on a recording drum or sheet *L*. The galvanometer *J* is provided with contacts *32* and *33* against which the extremity of the handle *34* is adapted to press when deflected on either side, and so complete either of the two circuits *35* and *36* which are adapted to send current through the armature in opposite directions and so effect a reversal thereof, the circuit *36* including the battery *37* and the circuit *35* including the battery *38*. The galvanometer *J* is connected between the junction point *24* and a wire *39* which parallels the bridge wire *21* and is adapted to be connected thereto by the sliding contact *30'*. It will thus be seen that when the galvanometer is, for example, deflected to the left, contact at *32* is made and the battery *38* sends a current through the armature which rotates in such a direction as to pull the contact *30'* to a position which will establish the balance on the bridge wire again, and bring the galvanometer needle to undeflected position. When the needle is deflected to the right, contact with *33* is made and the battery *37* is set in operation causing the motor to reverse and drawing the contact *30'* over to the other direction on the bridge wire, and so restores the balance.

In the operation of this part of the invention as a whole, the thermometer *A* is carried to any distance where it is required to measure the temperature, provided a similar length of compensating wire *F* is run. For instance, the thermometer may be fixed over the side of the ship and trailed through the water at a distance of a few feet below the surface, the wires passing through a suitable inclosing and protecting covering, such as copper and lead tubing. The resistances in the box *E* are then adjusted so as to enable the fluctuations in temperature to be measured on the bridge wire, the large changes in temperature being taken care of by changes in the resistance box *E*. As the thermometer is designed principally to measure extremely small changes in temperature, the principal use of the resistances will be when working in water of different degrees of temperature. The switches *22* and *23* enable either of the bridge wires *20* or *21* to be thrown into circuit, the bridge wire *21* permitting the separate reading to be made on the galvanometer *H*, while the bridge wire *20* continuously records the reading, the scales on the chart or drum being made to correspond.

In Fig. 3 a form of apparatus is illustrated particularly useful for the detection of the presence of icebergs and in which two thermometers A^1 and A^2 are connected differentially, the former being located a short distance below the surface and the latter as deep down as it is possible to place it, the object being to cause one thermometer to be affected by the light surface currents and particularly by the currents of fresh water flowing from an iceberg, while the lower thermometer will measure the temperature of the ordinary sea water, which will vary only slightly. The general arrangement of the connection of the two thermometers is the same, two opposite arms of the bridge being formed by the thermometer coils A and A^2 respectively, while the other two arms are formed by compensating coils F' and F^2 respectively and compensating wires G^1 and G^2 respectively. In this way the galvanometer will be deflected by any difference in resistance between the thermometers.

With the apparatus above described it is possible to accurately and continuously register temperatures to one thousandth of a degree and to make registration when the ship is going at full speed. As before stated, it is only with such accurate and continuous measurements that the peculiar conditions present in the water when approaching an iceberg, namely, a slightly raised temperature followed by a rapidly decreased temperature, can be noted.

The method and apparatus are also useful for a variety of other purposes. For instance, in hydrographic work, boundaries of currents and their variations of position with tides, seasons and the like can easily be worked out from a series of continuous temperature records of the type described. It has also been found that shoals, and the proximity of land appear to produce disturbances in temperature, which can be detected by the present apparatus.

Ornamental Lighting for Newport.

Plans for ornamental electric lighting in Newport, Ky., are proceeding rapidly, officers of the Union Light, Heat & Power Company having made a tentative arrangement with the city. Under the plan proposed, which varies somewhat from the usual system, the cost of laying conduits, erecting ornamental standards and installing the service will be shared jointly by the city and the merchants who will be benefited, while the maintenance cost of the lighting will be borne by the city entirely. The city will own the installation. The lighting company has quoted a low rate on the business.

Electricity in Mining.

As part of its mine-accidents investigations, the Bureau of Mines is studying the problem of safeguarding life and property from the dangers that attend the use of electricity underground. One of its inquiries has to do with the removing of a possible cause of mine explosions through the use of explosion-proof motors—that is, motors with covers for those parts that emit sparks. Another investigation has to do with the determination of the most efficient and safest types of insulation for use about mines and metallurgical plants in order to protect miners and other employees from shock. Still another line of investigation relates to the possibility of igniting explosive gases through the breaking of incandescent electric lamps in the presence of such gases. Other investigations relate to the electric firing of shots and to other uses of electricity in mining operations.

The preliminary recommendations of the Bureau in regard to regulations concerning the use of electricity in mines have been generally accepted by mining engineers and have been incorporated in the mining law of one mining state.

"Made in Chicago" Show.

There will be in the Coliseum, Chicago, Ill., October 5 to 13, an exposition of home products known as the "Made in Chicago" Show. This will not be devoted to any particular trade but will cover everything manufactured or produced in the city of Chicago. It is thus intended to be strictly local and only goods manufactured within 50 miles of the city, in the State of Illinois, will be admitted. Visitors, however, are expected from a far greater radius. The office of the management is at 319 Peoples Gas Building, Chicago.

A MODERN MOTOR-DRIVEN PLANING MILL.

By H. Cole Estep.

The Milwaukee Lumber Company has recently completed a large planing mill in connection with its plant at St. Maries, Idaho, and has equipped it throughout with individual motor drive. The electricity will be furnished by an exhaust-steam turbine using steam from the main saw-mill engine, which would otherwise go to waste. It is claimed to be the first planing mill in the United States to be driven entirely by electricity generated in this manner. On account of the large amount of refuse available for burning under boilers, power can usually be produced very cheaply at lumber mills, and the many advantages of electric drive are generally little appreciated. The adoption of motor drive in connection with an exhaust-steam turbine by one of the largest lumber companies operating in the West, is therefore a distinct innovation of considerable significance and presages a wide future development along similar lines.

The new planing mill is operated in connection with a large saw mill, the distance between the two structures being about 300 feet. The building is of standard, open, heavy-timber construction, with the machines arranged in a row down the center of the main aisle. The planing mills, four in number, were built by the American Woodworking Machinery Company and are designed to surface planks up to 2 inches thick and 12 inches wide. Each of these machines is direct-connected through a flexible coupling to a 50-horsepower, 440-volt, three-phase, 60-cycle, Allis-Chalmers induction motor. The motors are designed to run at 1,150 revolutions per minute, using 63 amperes at this speed. The flexible couplings are of standard type, consisting of two flanges into which steel pins are inserted to carry small leather belts. The motors are set on timber foundations bolted through the floor sills, which are extra heavy.

The starting apparatus for each of the three 50-horsepower motors includes one plain, single-throw disconnecting switch and an Allis-Chalmers Bullock-type, 440-volt, 50-horsepower, potential starter. This apparatus is mounted on a post convenient to the machine, as shown in the illustrations.

In addition to the 50-horsepower motors connected to the four large planing mills, the equipment includes one 20-horsepower, 440-volt, 860-revolutions-per-minute motor, direct-connected through a flexible coupling to a small surfacer; one 30-horsepower, 440-volt, induction motor belted to a resawing machine, and a 20-horsepower, 660-revolutions-per-minute motor belted through countershafting to the various machines in the tool room, including a saw filer and setter, emery wheels, etc. The tool-room motor is suspended in a cradle hung from the roof trusses, leaving a clear floor space underneath.

50-Horsepower Motor Direct-Connected to Planing Mill.

On a platform in the center of the building there is mounted a 100-horsepower, 440-volt, Allis-Chalmers motor, direct-connected to two 80-inch Sturtevant fans, which furnish the air blast to carry away the shavings from the planing mills. The motor, which is mounted between the fans, is designed to run at 575 revolutions per minute, taking 125 amperes from a 60-cycle, three-phase circuit. This motor is controlled by an Allis-Chalmers Bullock-type, 133-ampere, resistance controller.

Special attention has been paid to the wiring to reduce the fire risk. The three main leads, of 600,000 circular mils each, are carried through the mill building on heavy insulators bolted to the lower side of the bottom chords of the roof trusses, and are dead-ended with strain insulators at their outer ends. The motor leads are taken off at proper in-

tervals and led to the disconnecting switches through heavy pipe conduits. All the connections between the starting boxes and the motors are also placed in conduits and when possible are laid under the floor. Thus it is seen that, with the exception of the main leads, which are of course heavily insulated, all of the mill wiring is in conduits, but is nevertheless accessible and easily available for inspection. Even those conduits which are laid under the floor may be easily inspected from beneath, since the floor is carried on posts about five feet high.

Short poles fitted with standard insulators carry the three high-tension wires from the planing mill to the generating station, which is located in the main sawmill building. The power is generated by an Allis-Chalmers, 3,600-revolutions-per-minute, 2,300-volt, 60-cycle, Parsons-type, low-pressure turbogenerator. This unit is designed to deliver a maximum of 500 kilowatts at 80-per-cent power-factor. Under ordinary conditions the turbine will be operated on exhaust steam from the Corliss engine which drives the saw mill. In this way a considerable saving in power is effected over the customary practice of driving the planing mill with a separate high-pressure steam engine and wasting the exhaust from the main mill engine. If additional power should be necessary, live steam can be supplied to the turbine from the main boiler plant. In installing the boilers, ample capacity was allowed to take care of a possible load of this sort.

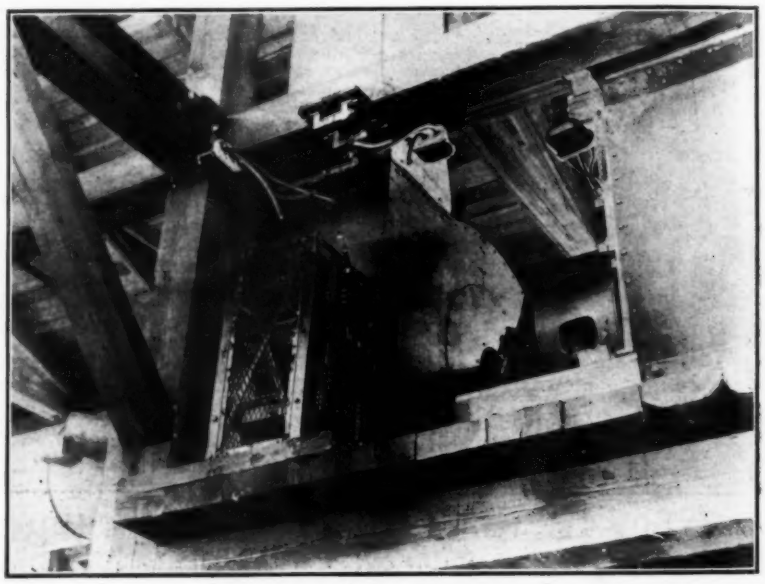
The turbine exhausts into a Tomlinson horizontal jet condenser, equipped with two injection pumps driven by a small Kerr turbine. The exhaust passages between the main turbine and the condenser are 30 inches in diameter.

Two exciters are installed; one is a steam-driven unit, consisting of a 120-volt, 83.5-ampere, direct-current generator, direct-connected to a 6-by-6-inch vertical engine, while in the other the engine is replaced by an induction motor operating at 1,130 revolutions per minute.

The main switchboards contains three panels, an alternating-current generator panel, an alternating-current feeder panel and a direct-current exciter panel. The exciter panel is provided with two shunt-field rheostats and an equalizer rheostat for operating the two exciters in parallel. The generator panel is equipped with a watt-hour meter which records the power generated, and is also provided with the necessary switches. The feeder panel is provided with the necessary switches for properly distributing the current throughout the plant. In addition to the foregoing, the switchboard is equipped with a General Electric automatic voltage regulator.

Three 100-kilowatt, oil-cooled, Westinghouse type S transformers are installed. Their primary windings receive current direct from the generator at 2,300 volts, and the secondaries deliver it to the line at 440 volts.

The Milwaukee Lumber Company will obtain the power necessary to operate its planing mill at practically no additional cost, since exhaust steam is used which in an ordinary mill goes to waste. The fixed charges on the cost of the electrical apparatus, together with the necessary maintenance and attendance, must, however, be charged against the cost of power for the planing mill, but these items are relatively small. As stated above, the cost of power is not a consideration of vital importance in connection with the saw mill. The electric drive has additional advantages which weigh heavily in its favor for lumber-mill service. The fire risk is considerably reduced, due to the absence of a boiler plant in the immediate vicinity of the planing mill; the danger of accidents is greatly lessened on account of the absence of belts, shafting, pulleys, etc., and the certainty with which each machine may be controlled individually. In addition, there is the convenience due to individual drive, which permits the machines to be arranged so that a larger output may be obtained.



100-Horsepower Motor Driving Fans.

Illinois Northern Utilities Capital Increased.

Mention was made in these columns recently of the formation of the Illinois Northern Utilities Company to consolidate several gas and electric properties along the Rock River in Illinois. On April 23 the company certified to an increase of its capital stock from $1,000 to $20,000,000, thus showing that the plans are likely to be carried out.

Life Saving At Sea.

The American Museum of Safety has just made public the fact that Elbert H. Gary, on behalf of the United States Steel Corporation, has presented the museum with $5,000 towards obtaining a collection of the best devices for saving life at sea, as a permanent exhibit for demonstration and study, free to the public. Early next month, W. H. Tolman, director of the museum, with its safety inspector, will go abroad to attend the International Congress of Accident Prevention at Milan, and to study the best European methods for life saving at sea.

The policy of the museum is now being guided by Arthur Williams, who has just assumed its presidency, succeeding Philip T. Dodge, who felt obliged to withdraw on account of ill health and absence from the country. President Williams announces another gift of $5,000 from an "unknown friend" for research work in connection with industrial poisons. Charles A. Doremus is chairman of this section of the museum's activities. The public is not only invited to visit the museum, at 29 West Thirty-ninth Street, between 9 a. m. and 5 p. m. every day, to study its collections, but in addition its Jury on Exhibits requests inventors and anyone else with practical ideas for life-saving at sea, to submit them at the museum.

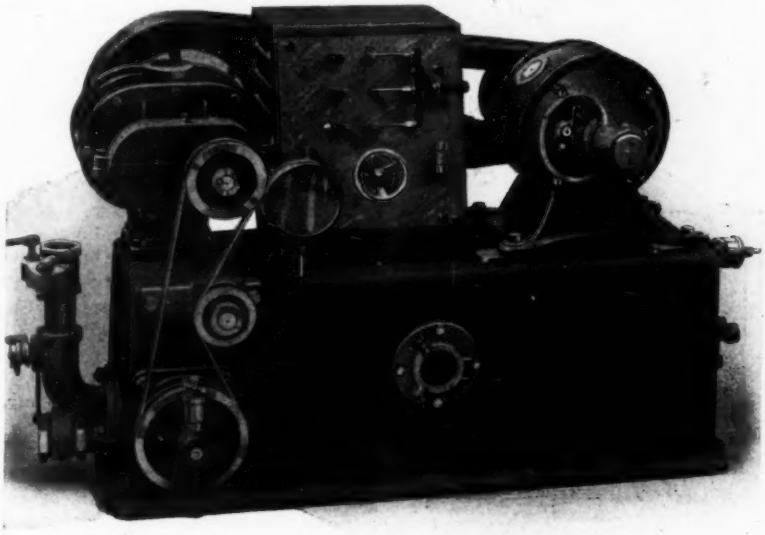
The growth in exports of copper, from less than $1,000,000 in 1882 to a probable total of $110,000,000 in the current fiscal year, has brought this article to fifth place among the great export staples of this country.

New Electrical and Mechanical Appliances

An Innovation in Vacuum Cleaning Machines.

The American Rotary Valve Company, 156 North Dearborn Street, Chicago, builder of vacuum cleaning machinery and Jenney electric motors, is producing stationary vacuum cleaning machines with a mechanical system of separation which entirely eliminates the use of screens, bags or strainer plates.

With this stationary system every particle of dust which is taken up by the cleaning appliance is carried through the system of piping to the base of the machine, which is located in the basement of the building in which it is installed. The dust, dirt and bacteria collected are eventually discharged to the sewer, the system being hermetically sealed at all times.



Stationary Vacuum Cleaning Machine.

When a room has been cleaned by the stationary system, it is not only cleaned as to appearance, but it is bacteriologically clean. In the case of some types of portable cleaners the air is exhausted back into the room and is literally alive with the germs and bacteria which it has collected, since it comes in contact with the contents of the bag that contains the dust and dirt gathered by the sweeping appliance.

This rotary vacuum cleaning machine has been designed to provide a sanitary cleaning system at a price within the reach of the general public. The machine is suitable for installation in residences, apartment buildings, hospitals, hotels, office buildings, etc. Such vacuum cleaning machines are now being installed in factories, stores and shops, as it has been demonstrated that it is possible to remove the dust not only from the floors but from the walls, fixtures, shelves and bins, resulting in a great saving by keeping merchandise free from dust, which has heretofore occasioned a very great loss to the store-keeper.

Machines of the type shown in the illustration are manufactured in several different sizes, ranging from one to any number of sweepers capacity that may be required to meet the size of the building.

The vacuum-producer is a positive rotary blower pump of the well known Root design, built especially for the work and operated by an electric motor with a silent chain drive. The pump and motor are mounted on a hollow base containing a mechanical dust separator. This type of separator is being used in connection with the vacuum machines that are now being installed by the company in the new New York Post Office which, when completed, will be the largest vacuum cleaning installation in the world. The hollow base on which the pump and motor are mounted is half filled with water from the service connection in the operation of cleaning, the separator being submerged therein. This results in perfect separation of all dust, dirt and bacteria from the air before it is exhausted.

This patented separator consists of a hollow, perforated cylinder in which there are four bronze paddles revolving at a high speed. These serve to break up all air bubbles and thoroughly mix the air and water, thereby releasing the dust and bacteria from the air. The air, which is well washed and purified, is taken up by the exhauster and expelled to the atmosphere direct or to a discharge pipe running to some convenient place for such discharge. The construction of this separator is such that it cannot become clogged with pieces of paper, matches, string or dirt. It is extremely simple and is designed so that there is nothing to get out of order or require attention during the life of the machine.

As previously stated, the sweepings, after passing through the separator, are conveyed to the base of the machine. The base is connected directly with the sewer, connections being closed by a valve at all times, except when the base is being cleaned and the collected sweepings discharged to the sewer. The method of discharging the contents of the base to the sewer is accomplished by reversing the exhauster by merely throwing a switch (thus converting it into a compressor), opening the sewer valve, and forcing the collected dirt and water from the base into the sewer by the pressure of the compressed air. The entire operation of disposal of the collected dust, dirt and water does not exceed two minutes. It relieves the operator of the necessity of opening the tank and cleaning out the collected contents, which is extremely unpleasant and unsanitary. The machine itself is not open to the atmosphere, being hermetically sealed at all times.

Another important feature of this vacuum cleaning machine is that by converting the vacuum-producer into an air compressor, compressed air can be blown through the system of pip-

ing and used for cleaning purposes in places that are inaccessible with a vacuum appliance, and for blowing out obstructions from the pipe and hose, thus doing away entirely with the rodding of pipes which has heretofore been necessary in case they became clogged.

The machine is furnished with appliances for cleaning rugs, hardwood floors, portieres, furniture, mattresses, draperies and even wall paper.

A New Electric Starter for Automobiles.

A demonstration of a new type of electric starting, igniting and lighting system for gasoline automobiles, invented and patented by E. V. Hartford, of the Hartford Suspension Company, was given to a company of New York automobile men and newspaper men at the United States Motor Company's building recently. The new device is declared to be a remarkable combination of simplicity, convenience and efficiency. Some of the striking claims made for it are that it is started from the driver's seat, is absolutely certain of operation, unaffected by temperature, poor carbureter action, or use of low-grade gasoline, and that it will continue the rotation long enough for any desired adjustment of throttle.

The system comprises a small but very efficient one-third-horsepower motor, weighing about 20 pounds. The amount of power which it consumes in starting the car is about 200 to 225 watts for average cars. This motor was designed to run at a very high speed (about 7,000 revolutions per minute), and its gearing consists of a worm and a worm wheel and a spur gear and pinion, giving a ratio of 100 to 1. This will turn a heavy car at a speed of 70 revolutions per minute. A small flywheel, about 2.25 pounds in weight, is mounted at the end of the motor shaft, the power of which increases as the square of the velocity and the momentum of this flywheel, when revolving at this very high speed, adds the stored-up energy to the torque of the motor.

The gears are always in mesh, the large gear having a positive roller clutch, which engages in starting and automatically disengages when the motor starts, which then rotates on a ball bearing. The worm gear is not keyed to the shaft, but is held in place by a friction device in which, in case of a premature explosion, the force of a "back kick" is dissipated.

The generator is of the permanent-magnet type, combined with electromagnetic fields of a new compact design mounted on ball bearings, and is entirely inclosed from outside elements.

Transformers for the Southern Sierras Power Company

The Fort Wayne Electric Works of the General Electric Company is furnishing to the Southern Sierras Power Company a large number of distribution transformers for outdoor service on 33,000-volt, 60-cycle circuits.

The transformers are of the shell-type construction, with separately wound primary and secondary coils. Each coil has a continuous layer of insulation and is spaced and separated from the other coils by means of heavy insulating channels and shields. The primary winding is so arranged

Outdoor Distribution Transformer for 33,000 Volts.

that the taps are brought out from the interior or neutral part of the winding in order to minimize danger of trouble at this point. The terminal block is submerged in oil.

The wire used in the high-voltage winding is first enameled and then doubly cotton covered. That portion of the winding which connects to the line has four cotton coverings, and the last turns of each coil are furthermore individually wrapped with a double thickness of varnished cambric or empire cloth, so that each turn will withstand several thousand volts breakdown test. This extra heavy insulation on the end turns is to enable the transformer to stand up under high-frequency discharges and line surges.

The high-tension insulators, tested at 80,000 volts, are cemented to an auxiliary cover bolted to the main cover; after the core, coils and main cover are in place the final connections between the coils and the high-tension terminals are made through an additional handhole in the main cover, which at the same time provides a convenient means of filling the transformer with oil.

The transformers have successfully withstood breakdown tests of 70,000 volts between primary and secondary and ground.

Especial care is taken in the construction of these transformers to prevent injury to the coils and core due to shifting during shipment. A heavy cast-iron cradle bolted to the base of the tank so supports both core and coils that there is practically no possibility of their shifting.

The H. W. Johns-Manville Company Moved to Larger Quarters.

The executive offices and New York showrooms of the H. W. Johns-Manville Company, manufacturer of asbestos and magnesia products and electrical supplies, were moved on April 20 to the new twelve-story H. W. Johns-Manville Building, Madison Avenue and Forty-first Street, New York City.

This move marks the fifty-fourth anniversary of the company. Under the name of H. W. Johns Manufacturing Company, the business was conducted at 87 Maiden Lane, previous to May 1, 1897, when it was moved to 100 William Street, where the headquarters have been located for the past 15 years. In 1901 the firm name was changed to H. W. Johns-Manville Company, a consolidation being affected between the Manville Covering Company, of Milwaukee, Wis., and the H. W. Johns Manufacturing Company. This combination brought together two of the largest manufacturers of pipe and boiler coverings, packings, roofings, etc., in the world, and the growth of the company since that time has been almost phenomenal.

It now has factories located in Brooklyn, N. Y., Milwaukee, Wis., West Milwaukee, Wis., Hartford, Conn., Nashua, N. H., Lockport, N. Y., and Newark, N. J., with an asphalt refinery at South Amboy, N. J., and extensive asbestos mines at Danville in the Province of Quebec, Canada, which are the largest in existence and produce an exceptionally fine grade of asbestos. The company also has a branch house in every large city in the United States and Canada, as well as representatives in nearly all foreign countries.

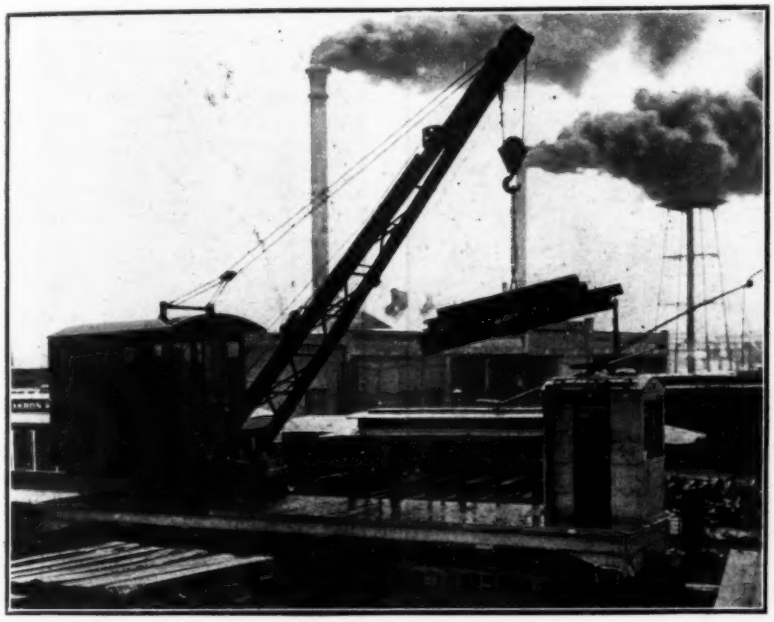
In the new quarters the company

will have the distinction of being one of the few manufacturing concerns which occupy an entire twelve-story office building. In its entirety, the company now occupies over 2,657,160 square feet of floor space, or about 61 acres.

Increased business interests in this and other parts of the country have necessitated the move. The large floor area and spacious rooms in the new building will enable a much larger and more complete stock of goods being carried on hand than heretofore, and will also permit of a better supervision over the company's long chain of branch offices, warehouses, stores, and factories.

Electric Work-Car Crane.

The value of steam-operated wrecking cranes has been shown on every large railroad where they have been employed to aid in construction work as well as to clear up blockades from wrecked freight cars, etc. The increasing weight of electric-railway equipment now frequently calls for a similarly equipped electric crane for service along the lines.



Electric Work-Car Crane.

To meet this demand the Browning Engineering Company, Cleveland, Ohio, has developed and placed on the market an electric work-car crane. As shown in the illustration herewith, this crane is mounted upon a standard street-car truck, which is propelled in the same manner as any electric street car and will travel at the same speed. It is regulated with a regular railway-type controller, and receives current through a trolley pole in the same way as street or interurban cars.

The capacity ranges from 3.5 to 15 tons, depending on the radius, which may be changed from 10 to 30 feet. The crane has a 38-foot boom which is equipped with a hook block. This block is kept in a central position and not allowed to twist with its load by means of a counterweight buggy placed upon the side of the boom. The crane rotates in a complete circle and the boom can be lowered or raised at the same time. In other words, the crane can simultaneously be rotating, the boom raising, and the load also raising or lowering, which effects a considerable saving of time.

This crane can be equipped to handle a 1.5-cubic-yard clam-shell or orange-peel bucket, which is very desirable for digging or filling cars, for making ditches, or handling coal or ashes. The crane is already used on several Ohio lines with complete success. In case of a wreck, the crane can be immediately sent out, the boom hooked to the wrecked car and the latter replaced upon the track in a very short time. This all can be done with comparatively few men and minimum delay to traffic.

Steam-Electric Fire Engine.

A new type of fire engine has been put in service in New York City. It is a composite unit consisting of a standard steam-engine pumping outfit with an electric traction equipment. The front wheels, axle, shaft and, in fact, the entire horse pulling equipment have been removed and in their place there were fitted two motor-driven couple gear wheels, steering apparatus, a storage battery and electric control equipment. The rear part of the apparatus looks not unlike any ordinary fire engine. As this represents the greatest investment in such a machine the scheme of displacing the horses only permits the present pumping equipment to be utilized to the end of its useful life.

In recent tests this new New York machine attained a speed of twenty miles an hour on the level and climbed a heavy grade at between eight and ten miles an hour. It is 11 feet 4 inches long and can turn in a 36-foot circle.

Electric Trucks in Louisville.

Following the recent purchase of a 3,000-pound Walker electric truck, the Louisville Lighting Company has purchased two 1,000-pound Waverley electric trucks. The trucks will be used for distribution work and repair purposes. They will take the place of three wagons with their six horses. The Louisville company's associated corporation, the Louisville Gas Company, and is also to install two Waverley trucks, and it is the ultimate intention of the companies to dispense with most of their horse-drawn equipment. P. T. Glidden, general manager of the lighting company, believes that the trucks will be an economy, and he also regards them as good advertising for the company and for electrical trucks, which are just beginning to make headway in the Louisville market, most of the cars there being gasoline.

Series Metallic-Flame-Arc Lamps.

The intense white light, resembling daylight, and the long life of electrodes and high efficiency, make metallic-flame-arc lamps particularly desirable for the lighting of streets, railroad yards, and other large areas, where series circuits are generally used because of the large saving in copper thus obtained. In the metallic-flame-arc lamps manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., the value of these desirable features is enhanced by the excellent distribution of the light, obtained by the clever allocation of the electrodes and reflectors. This is such as to produce uniform illumination; there is no intensely bright spot directly under the lamp, and no shadow rings. Most of the light is emitted at a wide angle, so that a large area is uniformly lighted.

The high efficiency of metallic flame lamps is due to the fact that not only the end of one electrode is luminous as in the carbon arc, but the entire arc flame emits a bright light, owing to the presence of the volatile material.

In the Westinghouse lamps the vapors produced by the metallic oxides of which the electrodes are composed, are not permitted to come in contact with

any solid substance in the lamp chamber, and therefore do not deposit as soot. The construction is such that air currents pass down over the inner surface of the globe and down along the electrodes, then out through a chimney. These air currents serve to carry off the vapors and soot and also to steady the arc so that it does not run up the side of the upper (negative) electrode.

The negative electrode is on top, so that most of the light is thrown downward, as the brighest part of the flame is near the negative electrode. A reflector directs downward the small part of the light emitted above the horizontal, and the globe is so designed that reflections from it are in a downward direction. The lower electrode is stationary and the upper electrode feeds, maintaining the arc always within half an inch of the same position.

The feeding mechanism is entirely free from floating parts and is remarkably simple and rugged. When the lamp is out, the upper electrode is held away from the lower and the cutout contacts are closed. All magnets and electrical parts are of generous size and easily removed. The starting resistors are wound on grooved spools and are of special wire that does not become brittle or granular. The cutout is extremely simple and reliable and has carbon and copper contacts. A nonsticking dashpot with self-lubricating graphite plunger, damps the armature of the feeding magnet. The clutch is a hardened-steel punching similar to the clutch commonly used in carbon arc lamps.

The simplicity of the lamp construction makes very few insulated parts necessary. Only solid mica and porcelain insulation are used. Each lamp is tested at 3,000 volts, alternating, for one minute, before shipping.

The frame consists of heavy metal punchings and is therefore almost unbreakable, yet light in weight. The main portion of the frame is formed by the chimney tube, hung from a heavy punched cap which carries the two terminal posts and the hanger.

A loop of non-corrosive metal reinforced at the top, where wear is greatest, provides means of suspension. This loop encircles a porcelain insulator that is held in a punched sheet yoke with a heavy cotter pin.

Two-screw binding posts drilled for No. 4 wire are held securely in porcelain insulators. The square shanks of these posts prevent twisting.

The case is formed from heavy, black-finished copper. It is of the entirely-removable, slip type, and is secured in place with a three-point bayonet joint at the top. A knurled machine screw, inserted through the case near the top, and turned into a hole in the frame, effectively locks it in position. The case can be locked in any one of the three positions at which the bayonet joints will engage. When the case is taken off the entire lamp mechanism is exposed and rendered very accessible for inspection.

Two types of case are furnished for these lamps. One uses a flat globe as shown in Fig. 3, which is used principally for the outside illumination of buildings, as it does not throw a shadow on the front of the building. The type shown in Fig. 1 is used for ground illumination; all light is thrown below the horizontal.

A mixture of metallic oxides forms the upper (negative) electrode, and the lower (positive) electrode is a composite metal button. The upper electrode is 16 inches long and approximately half an inch in diameter. Both electrodes are changed at each trimming.

The positive electrode is held on a goose-neck casting so arranged that it can be swung to one side when inserting the negative electrode. The negative electrode is held in a split bronze sleeve having a stem with a flexible conductor attached to its upper end. This holder slides in a guide tube which protects the holder from fouling due to deposit of the arc vapors, and is also arranged to prevent twisting.

All Westinghouse metallic-flame-arc lamps are adjusted, before shipping, for a 0.43-inch arc length, which will ordinarily give an average terminal voltage of 68. Two different styles of each type can be furnished. One is adjusted for a current of 4 amperes and the other for 6.6 amperes. The same lamp cannot be adjusted for both currents. Two adjustments are provided, one for the length of the arc and the other for maintaining the voltage across the arc at its normal value. The length of arc is adjusted by means of a screw which permits the electrodes to be so spaced as to obtain a normal arc voltage. The shunt cutout adjustment limits the voltage of the lamp.

Fig. 1.

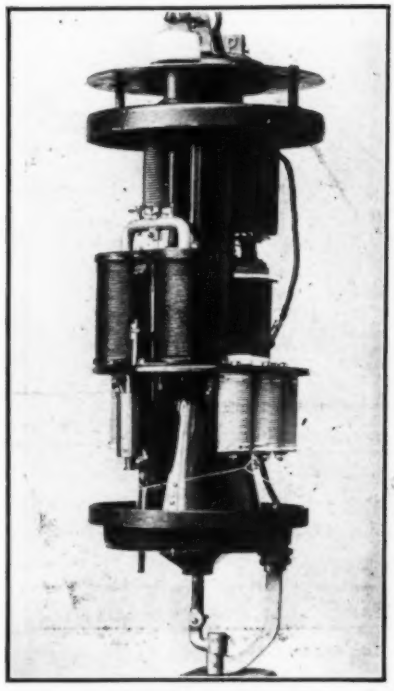


Fig. 2.

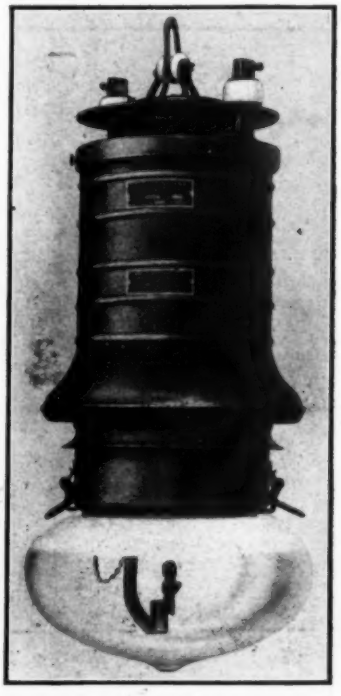


Fig. 3.

A Repair Kit for Meter Men.

The watt-hour-meter repair kit illustrated herewith is designed for the convenience of meter testers and repair men and contains all the tools usually required for this work. The loops for holding the tools are adjustable, however, so that different tools may be added or substituted as desired to meet special conditions. The case is made of strong pliable black leather, specially selected, with retaining flaps of the same material and two leather binding straps. The kit shown in Fig. 2 contains the following tools: One four-inch screw-driver, one two and one-half-inch screw-driver, one four-inch pin screw-driver, two No. 0 flat wrenches, one socket wrench, one pair four-inch diagonal cutting pliers, one pair three-inch flat long-nose pliers, one pair four-inch tweezers, one tooth-brush, one pocket level, and one bottle of watch oil.

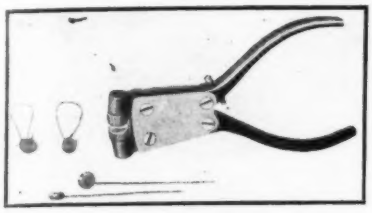


Fig. 1.—Sealing Tool.

Fig. 1 shows a sealing tool and seals used for sealing watt-hour meters. This tool is six inches long, the maximum distance between handles is three and one-half inches and the weight is ten ounces, enabling it to be carried in the pocket without any inconvenience.

The jaws of the tool are fitted with removable dies between which the seal is compressed. The removable feature of the dies enables one tool to be used for either plain or engraved sealing. A set-screw in one handle permits the adjustment of the tool for a minimum closing distance of the jaws.

The seal consists of a small lead disk attached to two strands of wire twisted together. There are two holes in the disk enabling the wire to be passed through it twice, thus making it impossible to withdraw the wire after the seal has been compressed by the tool.

These devices are manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

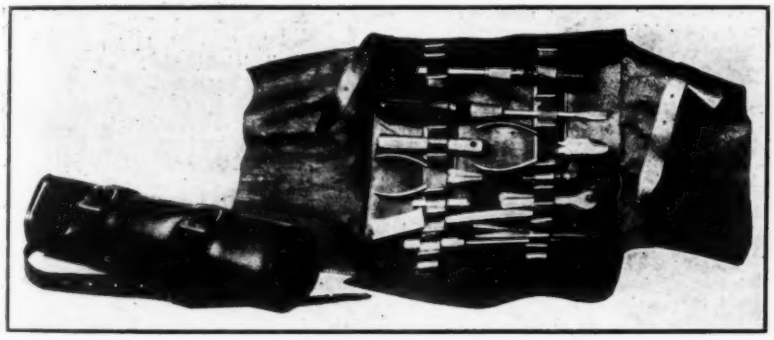


Fig. 2.—Repair Kit for Meter Men.

Spark-Gap Lightning Arresters.

The illustrations herewith show two types of spark-gap arresters for low-voltage use that are manufactured by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The type MP is used on cars, on lines, and in stations for railway service, and the type C is an inexpensive device for the protection of overhead lines.

The type MP or multipath arrester, for use on 440 volts alternating current or 600 volts direct current, has for its working part a block of special composition, over the surface of which the discharge spreads itself along a number of minute discharge paths. The voltage across each gap is very small, but owing to the large number of gaps the line voltage can not maintain an arc across them. The arrester has an indefinitely long life and affords a freedom of discharge very great compared with ordinary air spark-gap types.

For installation under various conditions, three different styles of inclosing cases are furnished for the type-MP arrester. In all three the cases are of galvanized iron and substantially constructed. The covers close against felt gaskets and are held by rugged spring-toggle latches. The car-mounting style is so constructed that when the cover is removed the working part comes out with it; it is therefore convenient for mounting under car sills and in other inaccessible places. The pole-mounting style has the mounting lug located at the bottom, so that the cover can be removed for inspection without dropping out the working part. The conduit-wiring style (Fig. 2) is mounted in a larger box having a conduit hole tapped with standard three-eighths-inch pipe thread; the ground lead is connected directly to the box, and the conduit system should be grounded. About five type MP arresters per mile are recommended for line protection, and one on each car.

The type-C arrester, for 500 to 2,500 volts alternating current, consists of seven cylinders of non-arcing metal mounted between overhanging porcelain supports and inclosed in a weatherproof iron box. As shown in Fig. 1, leads are brought out from the first, last, and middle cylinders. For lines up to 1,250 volts, one arrester can be used as a protection for both sides of a two-wire circuit, the middle lead being grounded. On higher voltage one outside lead is grounded and the arrester is a single-pole device. The static charge spreads over the surface of the cylinders and jumps across the gaps between them. This lightning arrester, because of the large size of the cylinders, has an instantaneous current capacity that materially aids in clearing the line of disturbances, while its equivalent spark-gap is extremely low. This device has successfully withstood the test of hard conditions and gives reliable protection under the conditions for which it is intended.

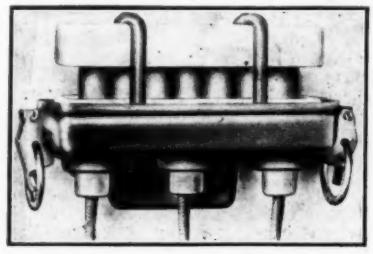


Fig. 1.—Type-C Arrester.

Fig. 2.—Type-MP Spark-Gap Arrester.

The type C arrester is intended for use on circuits having a load capacity not exceeding 200 kilowatts, if installed within a radius of two miles from the source of power. An additional capacity of 100 kilowatts is permissible for each additional mile. These limits are specified to allow for the ability of the arrester to successfully suppress a power arc following a discharge.

Latest Approved Fittings

CONDUIT, UNLINED.—Central Tube Company, 35th and Smallman Streets, Pittsburgh, Pa.

"Central White;" galvanized exterior, red oxide baked enamel interior.

"Central Red;" red oxide baked enamel interior, galvanized and red enamel exterior.

"Central Black;" black enameled conduit.

Conduit shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, has label attached to each length. This manutacturer is equipped to supply this conduit so labeled.

Approved April 3, 1912.

FIXTURES.—I. P. Frink, Twenty-fourth Street and Tenth Avenue, New York, N. Y. H. W. Johns-Manville Company, Sole Agents, New York, N. Y.

Fixtures shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, have labels attached to each fixture. This manufacturer is equipped to supply these fixtures so labeled.

Approved April 3, 1912.

FLEXIBLE CORD.—Flexible cords shown by tests and examinations conducted by the Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have labels attached to each coil. The following companies are equipped to supply these cords so labeled, these cords conforming to the standard of the 1911 edition of the National Electrical Code.

American Steel & Wire Company, Worcester, Mass.

Marking: Soft woolen thread on rubber surface lengthwise of wire and under braid.

Approved April 8, 1912.

Alfred F. Moore, 200 North Third Street, Philadelphia, Pa.

Marking: Red, white and blue cotton thread cabled with copper strands.

Approved April 9, 1912.

National India Rubber Company, Bristol, R. I.

Marking: Two blue threads cabled with copper strands.

Approved April 9, 1912

Okonite Company, Limited, 253 Broadway, New York, N. Y.

Marking: Ridge on rubber insulation.

Approved April 9, 1912.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

Roebling's Sons Company, John A., Trenton, N. J.

Marking: One blue thread parallel with the cord under the braid.

Approved April 9, 1912.

Rome Wire Company, Rome, N. Y.

Marking: One yellow and one green thread together and laid parallel with conductor between rubber insulation and braid.

Approved April 9, 1912.

Safety Insulated Wire & Cable Company, 114 Liberty Street, New York, N. Y.

Marking: Yellow thread in cotton wind around copper strand.

Approved April 9, 1912.

Simplex Electrical Company, 201 Devonshire Street, Boston, Mass.

Marking: One red thread parallel with conductor between rubber insulation and braid.

Approved April 9, 1912.

Standard Underground Cable Company, Westinghouse Building, Pittsburgh, Pa.

Marking: Brown thread cabled with copper strand.

Approved April 9, 1912.

Waterbury Company, 80 South Street, New York, N. Y.

Marking: Two black threads running parallel with the wire between rubber insulation and the braid.

Approved April 9, 1912.

GROUND CLAMPS.—Harvey Hubbell, Incorporated, 35 Organ Street, Bridgeport, Conn.

"Abbott Clamp."

Copper-plated steel ground clamps for use with pipes from one-half to 3 inches in diameter.

Approved April 18, 1912.

SIGNS, ELECTRIC. — Strauss & Company, 440-442 West Forty-second Street, New York, N. Y.

Electric signs shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have standard labels attached to each sign.

Approved April 3, 1912.

SIGNS, ELECTRIC.—Federal Sign System (Electric), 229 West Forty-second Street, New York, N. Y.

Electric signs shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined at factories and passed by Underwriters' Laboratories, have standard labels attached to each sign. This company is equipped to supply these signs so labeled.

Approved April 3, 1912.

SWITCH BOXES.—Burns, Pollock Electric & Manufacturing Company, 3327-3329 Block Street, Indiana Harbor, Ind.

"B-P." cast iron single boxes for use with flexible tubing in new work.

Approved April 18, 1912.

WIRES, RUBBER-COVERED.— Rubber-covered wires conforming to the specifications of the 1911 edition of the National Electrical Code and properly labeled by the Underwriters' Laboratories, are supplied by the following additional manufacturers.

Phillips Insulated Wire Company, Pawtucket, R. I.

Marking: Two black strands woven parallel in braid. Black core.

Approved April 3, 1912.

Crescent Insulated Wire & Cable Company, Trenton, N. J., for Alfred F. Moore, Philadelphia, Pa.

Marking: Red and blue threads crossing in braid.

Approved April 3, 1912.

American Electrical Works, Providence, R. I.

Marking: Three red threads woven parallel in braid. Black core.

Approved April 3, 1912.

Bay State Insulated Wire & Cable Company, River Street, Hyde Park, Mass.

Marking: One black thread running parallel with wire between rubber insulation and braid.

Approved April 3, 1912.

Small Wireless Set.

Probably the smallest wireless telegraph set ever made has just been perfected by the officers in the army signal corps laboratory and has been sent to New York for the aeronautical show, which is to be held there. The receiving and transmitting apparatus weighs only 25.5 pounds and is confined within a box 15 inches square and 16 inches deep. The generator from which the apparatus derives its power adds an additional 26 pounds.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

RAY, N. D.—The Williston Electrical Construction Company has been granted a franchise here.

GILBERT, MINN.—H. A. Rademacher is at the head of a movement to install a "White Way." C.

REDFIELD, S. D.—Cluster lights will be installed on the business streets and on some of the residence streets.

NASHVILLE, TENN.—The Tennessee Power Company has been incorporated with a capital stock of $20,000.

OAK HARBOR, O.—The City of Oak Harbor is planning the installation of a municipal electric lighting system. H.

NEWTON, KANS.—The Kansas Gas & Electric Company expects to expend $10,000 on rebuilding its power plant here.

COPERAS COVE, TEX.—George Kalker, of San Gabriel, is planning to erect an electric light plant and ice factory here.

ELGIN, ORE.—The Eastern Oregon Light & Power Company has been granted a franchise for a light and power system.

LEXINGTON, VA. — Rockbridge Power Corporation is planning to build a hydroelectric plant at Goshen Pass to develop 8,000 horsepower.

NEW BRAUNFELS, TEX.—Bids will be received until May 22 by Mayor C. A. Jahn for the construction of an electric light and waterworks plant.

WILLIAMSBURG, IOWA.—A franchise has been granted to the Troy Canning Company to install and operate an electric light plant.

CAMDEN, N. J.--The City Council has authorized a bond issue of $300,000 for the purpose of building and operating a municipal lighting plant.

BALSAM LAKE, WIS.—A franchise has been granted to Harry D. Baker, of St. Croix Falls, to operate an electric light and power plant.

MARION, KY.—The Marion, Electric Light & Ice Company, has made plans for issuing bonds to cover the cost of making improvements to its plant. G.

SANTA ROSA, CAL.—The Great Western Power Company has been granted a 50-year franchise to transmit electricity over certain highways of the city.

ASHLAND, KY. — The Ashland Steel Company will require motor equipment for the operation of five large cranes which will be installed.

CEDAR RAPIDS, IOWA.—The Troy Canning Company has been granted permission to install and operate an electric light plant for public and private use.

ARGENTA, ARK.—The Argenta City Council has passed an ordinance appropriating $18,500 for enlarging and increasing the capacity of the municipal lighting plant.

SYLVANIA, O.—Owing to a number of important industries locating in the little town of Silica, four miles west of this city, this city will put in an electric lighting system. H.

LINTON, IND.—Henry Gastman and others of this city have purchased the Odon Power Light Company's plant, and announce that extensive improvements will be made. S.

BARBOURVILLE, KY.—The Barbourville, Light, Heat & Power Company has been purchased by George W. Tye and A. D. Smith. The new proprietors will make improvements.

McCOLL, S. C.—P. B. Parish, Clio, has obtained a franchise to furnish electricity in McColl and will transmit the power from its hydroelectric plant on the Pee Dee River, about ten miles east of Clio.

LAKE VILLAGE, ARK.—Delta Light, Power & Manufacturing Company has a franchise to erect an electric light and power plant. E. J. Lenz, Greenville, Miss., is chief engineer and superintendent.

WACO, TEX.—It is announced that the Southern Traction Company will build a power house within the corporate limits of Waco, which, when completed will represent an outlay of $800,000.

FRANKFORT, KY.—The Kentucky Public Service Company, which owns the plant formerly operated by the Capital Gas & Electric Light Company, is planning the construction of a power house. G.

WILMINGTON, DEL.—The Hillcrest Improvement Association is considering a change in the system of street lighting of Hillcrest, by replacing the gas lamps with six to nine 40-candle power tungstens.

CHARLES CITY, IOWA.—The City Council has decided that Charles City shall have a municipal lighting and pumping plant and an election will be held for the issuance of $25,000 worth of bonds to finance the project.

WINNIPEG, MAN.—The department having charge of the civic light and power have already called tenders for 2,000 poles and it is expected that there will soon be considerable activity in the matter of line construction.

BOUTON, IOWA.—Bouton Opera House Electric Light & Power Company of Bouton has been incorporated with a capital stock of $10,000. The incorporators include J. A. Dissinger, William S. Arthurs and H. H. Meiser.

LOS ANGELES, CAL.—The American Power Company of California has been incorporated with $2,000,000 capital stock by N. O. Harmon, C. M. Ferre, R. M. Blodget, H. Waterman, S. J. Powell, G. E. Harpham and W. A. Harmon.

MISSOULA, MONT. — Pleasant View Power & Irrigation Company has been incorporated with a capital stock of $100,000 by Kate M. McCormick, W. J. McCormick, John F. McCormick and Honora McCormick Houghton, all of Missoula.

OXNARD, CAL.—Bonds in the sum of $30,000 for the construction of a municipal street lighting system are to be issued. Said bonds shall be 60 in number, of $500 each, bearing five per cent interest, payable semi-annually on May 1 and November 1.

OROVILLE, CAL.—Work has been started by the Great Western Power Company on its dam at Big Meadows. The Company proposes to make five developments of power between Big Meadows and Oroville, the total capacity of which will be 600,000 horsepower.

MANKATO, MINN.—The Consumers Power Company, of Chicago, will begin to construct its line in Southern Minnesota. Franchises for light and power have been secured from Janesville, Waseca, Waterville, Kasota, and other intermediate points.

THOMPSON FALLS, MONT.—John D. Ryan, R. L. Agassiz, John G. Marony and others have acquired large waterpower rights on the Columbia River at this place, and a power plant, capable of developing 46,000 horsepower, will be built immediately.

MELFORT, SASK.—Tenders will be received until May 29 for the installation of water works, sewerage and electric light systems for this town. J. E. Durin, Melfort, is secretary-treasurer, and McArthur, Murphy & Underwood, Saskatoon, Sask., are the engineers in charge.

ASHEVILLE, N. C.—The Asheville Light & Power Company has acquired the properties of the Asheville Electric Company and plans for the development of a hydroelectric plant on Hominy Creek, water power site on French Broad River, eight miles below Asheville, and certain other enterprises. Over $3,000,000 of bonds will be issued for the improvements.

BURLINGTON, N. C.—The Alamance Power Company has been organized for the purpose of building a hydroelectric plant to develop the waterpower at River Falls on the Haw River in Alamance County, near Burlington. It is issuing $300,000 of bonds in connection with the proposition and expects soon to begin construction. F. L. Williamson, of Burlington, is president and treasurer; J. Harvey White, of Graham, is vice-president, and Charles E. Menefee, of Burlington, is secretary.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

PRATT, MINN.—The Pratt Rural Telephone Company will rebuild part of its main line. C.

ROCKFORD, MINN.—A franchise has been granded to the Tri-State Telephone Company. C.

GUTHRIE, MINN.—The Guthrie Telephone will extend its line about 15 miles this summer. C.

EUREKA, MONT.—Work will begin at once on the construction and installation of the Eureka Mutual Telephone system. C.

SYNAREP, WASH.—The Synarep Telephone Company has been organized for the purpose of building a line to connect this place with Riverside.

PAGES MILLS, S. C.—Hayes & Lester Telephone Company has been incorporated by W. E. Lester, of Pages Mills, and Charles P. Hayes, of Kemper, S. C.

BLACKDUCK, MINN.—George Tenyke is president of a telephone company just organized to construct a line to Battle River and Northome. C.

NEWARK, N. J.—The New York Telephone Company has been granted a 40-year franchise to construct an underground conduit system on the Plant Road.

SOUTH BEND, IND.—The Central Union Telephone Company has acquired the Osceola Telephone Company's property, and will improve and extend the plant. S.

VICKSBURG, MISS.—The Cumberland Telephone & Telegraph Company is planning an extension of its conduit work, at an estimated expenditure of $10,000.

BEATRICE, NEB.—The Home Telephone Company, and the Lincoln Telephone Company have consolidated and will place all the wires underground. C.

GEORGES CREEK, TEX.—Citizens' Telephone Company has been incorporated with a capital stock of $2,400 by T. A. Duncan, D. Ratliff and W. T. Howeth.

RUSHMORE, MINN.—Work will soon begin on rebuilding the telephone system. A new switchboard will be installed and the individual telephone system adopted. C.

MAPLETON, MINN.—Work will begin on the toll line of the Tri-State Telephone Company between Albert Lea and Alden, and will run to Winnibago and Delavan.

SHELBYVILLE, TEX.—The Citizens Rural Telephone Company has been incorporated with a capital stock of $2,116 by J. C. Crawford, Sam Smith, J. P. Windham and others.

MAPLETON, MINN.—The Farmers have organized a telephone company to be known as the South Mapleton line. Geo. M. Cooper is president, and Frank Phelps, secretary. C.

CLARKSVILLE, TEX.—It is announced that the Texarkana Telephone Company, of which Arlie C. Stewart is president, will remodel its telephone system, at an estimated cost of $8,000.

GUTHRIE, MINN.—The Malvig Telephone Company has been organized with J. O. Sunstad, president. The main line will be constructed about 10 miles west to connect with the Farris exchange.

ARMSTRONG, IOWA. — Northwestern Mutual Telephone Company has been incorporated with a capital stock of $3,000. The incorporators are J. T. Cheever, Roy B. Felkey and J. F. Houseman.

SLATYFORK, W. VA.—Marlinton & Elk Telephone Company has been incorporated with a capital stock of $625 by L. D. Sharp, Robert Gibson, John D. Gibson, Slatyfork; W. L. Gay and Levi Gay, Edray.

CALDWELL, KANS.—The North Fairview Rural Telephone Company has been incorporated with a capital stock of $500 by Floyd Parsons, G. B. Moore, F. L. Fisk, E. J. Springer and M. T. Fortmeyer, all of Caldwell.

MORRISTOWN, MINN.—Morristown Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are E. E. Bahr, Henry Knauss, William Liebernz, L. A. Kisor, L. F. Von Eschen, John Knauss, George Molm, H. D. Widrick, L. C. Temple, J. H. Buscho, of Morristown.

DOVER, DEL.—The Smyrna & Western Telephone Company has been chartered with a capital stock of $25,000. The incorporators are W. H. Tunis, Joseph M. Hazel, Joseph A. George, Charles F. George, Thomas Donnelly, W. C. Myers, of Clayton; Joseph Jones, J. H. Lamb, T. F. Lamb and W. W. Blodgett, of Townsend, and William Armstrong, of Smyrna.

BERTHOLD, N. D.—Berthold Farmers' Telephone Company has been incorporated with a capital stock of $50,000 to build a telephone line from Berthold to DesLacs, Hartland, Tagus and connect with rural lines running through the country. The directors are William W. Wixer, G. A. Luke, J. I. Porter, Theodore Schwinden, L. A. Mann and Nels P. Larson, of Berthold; M. D. Johnson, of Hartland, and W. G. Varnes, of DesLacs.

ELECTRIC RAILWAYS.

(Special Correspondence.)

BOISE, IDAHO.—It is reported that the Idaho Falls Electric Railroad will be built in the near future.

TAMPA, FLA.—It is reported that the Fidelity Realty Company expects to build a street railway on the island of Anna Maria Beach.

SAN BERNARDINO, CAL.—Bids will be received up to May 27 for the purchase of a 50-year railroad franchise over certain streets.

LOS ANGELES, CAL.—Bids will be received up to May 27 for a 40-year franchise to operate a railroad upon certain streets of Los Angeles County.

HOUSTON, TEX.—The Houston Electric Company will extend its street railway system through the northern part of the Magnolia Park suburb. D.

RICHMOND, VA.—The Richmond & Henrico Railway Company is reported as making preparations to build extensions to Montrose Heights, Oakwood and Swansboro.

WEBSTER CITY, IOWA.—It is announced that the Fort Dodge, Des Moines & Southern Interurban Company will electrify its Crooked Creek line this summer.

GLENDALE, CAL.—A 44-year franchise has been granted E. D. Goode for an electric line to run from this city to Griffith Park.

INDEPENDENCE, KANS. — A committee of Neodesha business men is co-operating with the Independence Commercial Association for a trolley line to connect the two towns, and also run to Chanute.

CORVALLIS, ORE.—The city has granted Portland, Eugene & Eastern Railway Company a franchise to operate an electric car line on the streets of Corvallis. The officials of the railway company state that the company will spend $250,000 on the work during the coming season.

SAGINAW, MICH.—General Manager J. A. Cleveland of the Saginaw & Flint Interurban Railway, has announced that his company will expend about $1,000,000 on improvements. It is planned to rush the work on the line to Bay City and have it in operation before the first of next year.

WINNIPEG, MAN.—The amalgamation of the Alberta Interurban Railway and the Manitoba Rural Railways is being talked of, which it is rumored foreshadows linking up the Canadian Prairie West cities by transit lines operated by hydroelectric power.

PHOENIX, ARIZ.—The Salt River Valley Electric Railway Company has started grading on its new interurban electric railway that is to run from Phoenix, Ariz., through the Salt River Valley for a distance of 35 miles. It will connect the towns of Scottsdale, Tempe and Mesa with this city.

SPRINGFIELD, MO.—It is reported that the Federal Light & Traction Company, of New York City, has received orders from the Springfield Traction Company to prepare an estimate on the extension of the latter company's line to the new entrance of the Springfield Country Club. A rough estimate of $20,000 is said to have been placed on the work.

ROCHESTER, IND.—C. M. Trusdale, representing the Chicago Trust Company, with a corps of engineers, has surveyed a proposed route from this city to Logansport for an electric railroad to be built by the South Bend and Logansport Traction Company. The right of way has been secured and it is promised that work on the new line will be started in a few weeks. S.

SEATTLE, WASH.—Articles of incorporation have been filed by the Seattle, Kenwood & Lake Forest Railway Company, with capital stock of $400,000. The object of the company is to construct an interurban line, running from Seattle in a northeasterly direction through the new town of Kenwood where it is proposed to establish its base of operations.

ROUNDUP, MONT.—Roundup Interurban Railwav Company has been incorporated with a capital stock of $100,000 for the purpose of building a line to connect Roundup with the coal mines near that city. The incorporators of the company are M. H. Klein, August Schrump, M. H. Wall, M. R. Swanson, J. W. Newton, E. E. Congdon and Charles Brockman, all of Roundup.

IOWA CITY, IOWA.—It is stated that Frank Tanner and other interested parties have purchased the interests of Smith & Dows, of Cedar Rapids, in the proposed Eastern Iowa Railway Company, and that arrangements have been made with the Keo-

kuk Power Dam Company to furnish power for running the cars when the line is built.

TOLEDO, O.—The Toledo Ann Arbor & Jackson, an electric railway between Toledo and Ann Arbor which was started several years ago and never finished, will be completed within a short time. A new company has come into control of the property and announces its intention to complete the road immediately. George E. Fisher, of Detroit, has charge of the construction work. H.

ALBANY, N. Y.—The Manhattan & Jamaica Railway Company of New York has been incorporated with a capital stock of $300,000 to operate a street surface road, some 15 miles long. The directors of the company are John S. Stetson, George J. Brigham, Brooklyn; William D. Sloane, Arthur G. Hume. Harold B. Weaver, William R. Wallace, Albert H. Flint, Hobart W. Maloney, New York; and Charles W. McChesney, Amityville.

SAN FRANCISCO, CAL.—The Sacramento Valley Electric Railway Company has been incorporated with a capital stock of $5,000,000 by Charles L. Donohue, H. W. Manor, L. P. Klemmer and J. Reith, Jr., all of Willows. The purpose of the company is to build an electric line furnishing inter-county electric service in six counties in California. A main line and two branches are planned, in all a distance of 160 miles.

SACRAMENTO, CAL.—Articles of incorporation have been filed by the Sacramento Valley Electric Railroad with a capital stock of $5,000,000. The route of the line will run from Red Bluff South through Tehama, Glenn, and Yolo Counties to Woodland, and then southeast through Davis and Dixon to connect with the Oakland, Antioch and Eastern line. A branch line will run from the main line through Williams to Colusa, on the Sacramento River. The directors of the company are Charles L. Donohoe, H. W. Manor, L. P. Klemmer and J. Keith, Jr., of Willows; and L. Sisson, of Red Bluff.

OTTAWA, ONT.—Two traction franchises known as the Ottawa & St. Lawrence Electric Railway, and the North Lanark Railway have been purchased by James A. Morden, secretary of the Red Willow Coal Company, Toronto, Ont. Mr. Morden announces that steps will shortly be taken to float a bond issue in London for the construction of 274 miles at a cost of $20,000 per mile. The route of the proposed line will be from Ottawa through 40 towns and villages, running south to Morrisburg, then west along the St. Lawrence River to Brockville, north through Lanark to Arnprior, and east along the Ottawa River to the starting point. It is expected to use the numerous waterfalls along the route for developing electric power.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Manufactures, Washington, D. C., and refer to the file number noted.)

NO. 8707. ELECTRIC AUTOMOBILES AND APPURTENANCES.—An American consul in a South American country has requested to be supplied with catalogues of electric automobiles and appurtenances, such as transformers, etc., as also the price of same f. o. b. New York City. Several inquiries have been received, and it is possible that sales may be effected.

NO. 8720. ELECTRIC HEATING AND COOKING APPLIANCES.—A business firm in the United Kingdom writes an American consulate that there is a demand for electric heating and cooking appliances, and it desires to get in direct touch with manufacturers only. It is of vital importance that those sending offers should give full particulars as to prices, measurements, descriptions, etc.

NO. 8722. ELECTRIC UTENSILS.—An American consular officer in a European country reports that an official in a local electric light company is about to open a store on one of the principal streets of the city in which he is located for the display and sale of all kinds of electric utensils and devices adapted for domestic use. Illustrated catalogues, prices, terms, and discounts are desired. Satisfactory references can be furnished. Correspondence should be in French or Italian.

NEW INCORPORATIONS.

KENT, WASH.—The Kent Electrical Manufacturing Company has been incorporated with a capital stock of $5,000 by George Schurman, A. A. Risedorph, and others.

TACOMA, WASH.—Articles of incorporation have been filed of the the Rainy Valley Electric Company with $25,000 capital stock. The incorporators are M. T. Slade, T. F. Palms, and others.

AMSTERDAM, N. Y.—Voorhees & Brown Electric Company has been incorporated with a capital stock of $10,000 by John H. Voorhees, Frederick W. Brown and Albert R. Larsonm, all of Amsterdam.

CLEVELAND, O.—The Rogers Electric Sales Company has been incorporated with a capital stock of $10,000 by Fred J. Langer, P. C. Greenweel, Lucien Seymour, Benj. Leland and Walter S. Lister.

CAMDEN, N. J.—The firm of Robert Scott, Incorporated, of which H. B. Martin is president, has been incorporated with a capital stock of $50,000. The company will handle electrical equipment.

RIPLEY, N. Y.—The Ripley Electric Company has been incorporated with a capital stock of $3,500 to manufacture electricity for power and light. The incorporators are Nathan J. Horton, John M. Wethy and J. Watson Burrows, all of Ripley.

NEW YORK, N. Y.—The Magneto-Dynamotor Company has been incorporated with a capital stock of $100,000 to manufacture magnetos, dynamos and accessories of all kinds. The incorporators are George L. Henry, Frank B. Moody and Battie T. Moody, all of New York City.

NEW YORK, N. Y.—The Riera Manufacturing Company has been incorporated with a capital stock of $3,000 to manufacture electrical fixtures, electric lamps, etc. The incorporators are R. Riera, of New York City; George H. Schulta, Jersey City, N. J.; and William A. Mangler, Brooklyn.

FINANCIAL NOTES.

A considerable break in leading securities toward the end of the week has brought about a keener appreciation of all the factors in the current speculative situation. This will have a useful purpose in conserving the market against further over speculation for a rise. However, while confidence in the recent market level has been shaken it cannot be said that confidence in the fundamentals underlying the present condition of industrial stability has been disturbed.

The Allis-Chalmers reorganization committee announces that sufficient assents and deposits having been received (representing more than 80 per cent of the outstanding first mortgage 5-per-cent bonds, and more than two-thirds of the preferred and common stock of the Allis-Chalmers Company) it has resolved to carry the reorganization plan into effect, subject to all the powers and discretion vested in it under the terms of the agreement of reorganization. Notice is given to bondholders and stockholders who for any reason have not deposited their bonds or stock with the Central Trust Company of New York as depository, that the time to do so has been extended to and including June 1, 1912, after which date no deposits will be received except upon such terms and conditions, and upon the payment of such penalty as the reorganization committee in its discretion may impose.

Application has been made to the New York Stock Exchange by the Pacific Power & Light Company, to list $5,295,000 first and refunding-mortgage five-per-cent bonds, due 1930.

Additional shares of stock have been listed on the Philadelphia Stock Exchange as follows: $172,000 American Telephone & Telegraph Company; $22,400 Philadelphia Rapid Transit voting trust certificates, making total of these certificates listed $20,709,400.

The Central Union Telephone Company, controlled by the American Telephone & Telegraph Company, has called for payment on July 1 at 105 its $2,500,000 first-mortgage six-per-cent bonds due 1916 and $3,500,000 consolidated-mortgage five-per-cent bonds due 1919. These two issues comprise the total funded debt of the company.

Boettcher, Porter & Company, of Denver, are offering at 100½ and interest first-mortgage sinking-fund six-per-cent gold bonds of the Nevada-California Power Company, dated 1907 and due 1927, redeemable at 105, of which there are $2,862,000 outstanding under a closed mortgage on property estimated at $2,000,000 in excess of bonded debt.

Boston Elevated gross in April, despite poor weather conditions, made second best gain of any month this year. The increase of $74,000 was almost 6-per-cent and compared with a gain of $61,000 in March and a record gain of $96,000 in February, April receipts for the first time demonstrated that there has been some increase in income because of opening of Cambridge subway.

At a special meeting of the Philadelphia Company an increase in the authorized capital stock from $48,000,000 to $73,000,000 was approved. The new stock will be six-per-cent cumulative and preferred as to assets. Stockholders also voted to issue $10,000,000 five-per-cent debentures maturing in ten years, and convertible at the holder's option into cumulative preferred stock par for par. Of the new preferred stock, $6,000,000 will be exchanged for the present preferred stock. $10,000,000 will be used for the conver-

sion of the $10,000,000 convertible debentures and $9,000,000 will be held in reserve for future requirements. The proceeds from the sale of the debentures will be used in upbuilding the street-railway properties owned by the company.

Stockholders of the New York State Railways Company will meet in Rochester, May 14, to pass upon the proposal of the directors to cancel the company's existing mortgage authorizing the issuance of $30,000,000 five-per-cent bonds and create in its place one authorizing a total issue of $50,000,000 bearing not more than four and one-half per cent interest. None of the bonds which are to be retired are in the hands of the public, and only $4,500,000 have ever been issued, these being in the hands of trustees. It is the company's intention to apply to the New York Public Service Commission for approval of an issue of the new bonds somewhat in excess of the amount necessary to refund the $4,500,000 mentioned above, for the purpose of paying for certain stock of the Syracuse Rapid Transit Company. New York State Railways Company is controlled by the New York Central.

Dividends.

American District Telegraph of New York; a quarterly dividend of one per cent, payable May 15 to stock of record May 1.

Federal Light & Traction Company, a regular quarterly dividend of 1.5 per cent on the preferred stock, payable June 1 to stock of record May 15.

Mobile Electric Company; a quarterly preferred dividend of 1.75 per cent, payable May 15 to stock of record April 30.

Portland Railway Light & Power Company; a quarterly dividend of one per cent, payable June 1 to stock of record May 11.

Southern California Edison Company; a quarterly dividend of 1.25 per cent, payable May 15 to stock of record April 30.

Reports of Earnings.

NEW ORLEANS RAILWAY & LIGHT.

The New Orleans Railway & Light Company reports for the three months ending March 31, 1912, compared as follows:

	1912	1911
Gross earnings	$1,730,711	$1,629,161
Net after taxes	730,141	661,022
Surplus after charges, etc.	317,012	260,353

SAO PAULO TRAMWAY.

The report of the Sao Paulo Tramway Light & Power Company for the year ending December 31, 1911, shows net earnings of $2,320,786, against $1,986,955 in 1910. The income account compares as follows:

	1911	1910
Gross earnings	$3,595,278	$2,949,293
Operating expenses	1,274,492	962,337
Net earnings	2,320,786	1,986,955
Charges	543,152	383,862
Surplus	1,777,634	1,603,093
Dividends	1,000,000	999,992
Renewals, etc.	300,000	200,000
Surplus	477,634	403,100

UNITED RAILWAYS OF BALTIMORE.

The annual report of the United Railways Company of Baltimore for the year ended December 31, 1911, is issued. The income account compares as follows:

	1911.	1910.
Gross	$8,025,758	$7,687,894
Expenses	3,681,093	3,601,896
Net	4,344,665	4,085,998
Other increase	2,640	2,490
Total increase	4,347,305	4,088,488
Charges	2,859,687	2,801,635
Surplus	1,487,618	1,286,853

At the annual meeting of the United Railways of Baltimore the old board of directors was re-elected.

HUDSON & MANHATTAN COMPANY.

At the annual meeting of the Hudson & Manhattan Company, Walter G. Oakman and William M. Barnum were elected directors to succeed Anthony N. Brady and W. H. Corbin, whose terms expired.

A preliminary statement was made by President McAdoo, giving the gross for the year ended March 31, 1912, as follows:

	1912.	1911.
Gross passenger receipts	$3,014,860	$2,546,349
Miscellaneous railroad revenue	206,224	148,690
Total income from Hudson Term. and other non-R. R. sources	1,608,726	1,470,452
Total gross	4,829,811	4,165,492

In a preliminary annual report to stockholders President McAdoo said the reason the full report was not issued is because the company's year ends March 31, and there is only ten days between the expiration of the year and the annual meeting. The fiscal year will hereafter end December 31. The full report will be issued shortly.

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of March and six months ended March 31, 1912, compares as follows:

	1912.	1911.
March gross	$ 427,664	$ 371,992
March net	156,696	137,508
Surplus after charges	101,175	91,085
Six months' gross	2,533,429	2,202,915
Six months' net	963,862	832,442
Surplus after charges	702,560	603,237

BAY STATE STREET RAILWAY.

The Bay State Street Railway Company (Mass. Electric) reports for the quarter ended March 31, 1912, compared as follows:

	1912.	1911.
Gross	$1,910,068	$1,797,326
Net	548,513	564,488
Surplus after charges	58,821	108,739
Nine months' gross	6,775,726	6,494,911
Nine months' net	2,320,651	2,404,321
Surplus after charges	893,643	1,039,762

ST. JOSEPH RAILWAY.

The report of the St. Joseph Railway, Light, Heat & Power Company for the year ended December 31, 1911, shows net earnings of $470,134, against $488,655 in 1910. The income account compares as follows:

	1911.	1910.
Gross earnings	$1,099,284	$1,038,055
Operating expenses	629,150	549,400
Net earnings	$ 470,134	$ 488,655
Fixed charges	283,783	274,057
Balance	$ 186,350	$ 214,598
Dividends	148,000	148,000
Surplus	$ 38,350	$ 66,598

NORTHERN OHIO TRACTION & LIGHT.

The report of the Northern Ohio Traction & Light Company for the month of March and three months ended March 31, 1912, compares as follows:

	1912	1911
March gross	$215,888	$190,186
March net	90,610	79,336
Surplus after charges	46,789	35,007
Three months gross	623,486	548,870
Three months net	256,117	226,248
Surplus after charges	124,651	93,133

AURORA, ELGIN & CHICAGO.

The Aurora, Elgin & Chicago Railroad Company reports for the month of March and nine months ended March 31, 1912, compared as follows:

	1912.	1911.
March gross	$ 133,523	$ 122,679
March net	53,830	47,766
Interest and taxes	36,934	35,947
March surplus	16,896	11,818
Nine months' gross	1,362,825	1,290,628
Nine months' net	596,602	546,478
Interest and taxes	330,337	308,693
Nine months' surplus	266,264	237,784

FONDA, JOHNSTOWN & GLOVERSVILLE.

The Fonda, Johnstown & Gloversville Railway Company reports for the month of March and nine months compared as follows:

	1912.	1911.
March gross	$ 74,201	$ 72,846
March net	34,691	37,846
Nine months' gross	704,098	701,440
Nine months' net	359,927	368,752

NEW ENGLAND TELEPHONE.

The report of the New England Telephone & Telegraph Company for the year ended December 31, 1911, shows net earnings of $3,130,803, against $3,312,802 in 1910. The income account compares as follows:

	1911	1910
Gross	$13,849,394	$13,171,709
Operating expenses	5,521,267	4,956,860
Taxes	824,901	770,681
Rep. and depreciation	4,372,423	4,131,366
Total expenses	10,718,591	9,858,907
Net	$ 3,130,803	$ 3,312,802
Interest	135,315	118,808
Net income	$ 2,995,487	$ 3,193,994
Dividends	2,644,521	2,350,686
Surplus	$ 350,965	$ 843,308

AMERICAN LIGHT & TRACTION.

The American Light & Traction Company reports earnings for twelve months ending March 31, 1912, compared as follows:

	1912	1911
Gross earnings	$ 4,104,550	$ 3,933,091
Expenses	118,356	119,521
Net earnings	3,986,193	3,813,569
Previous surplus	7,158,380	6,243,814
Total surplus	11,144,574	10,057,384
Preferred dividends	854,172	854,172
Common dividends	1,129,083	1,022,326
Stock dividends com.	1,129,107	1,022,505
Total dividends	3,112,363	2,899,003
Profit and loss surplus balance March 31	8,032,211	7,158,380

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 6.	Apr. 29.
Allis-Chalmers common (New York)	1¼	⅞
Allis-Chalmers preferred (New York)	3½	3¼
American Tel. & Tel. (New York)	146	146½
Commonwealth Edison (Chicago)	146	146
Edison Electric Illuminating (Boston)	292	292
Electric Company of America (Philadelphia)	*12	12
Electric Storage Battery common (Philadelphia)	55	55¼
Electric Storage Battery preferred (Philadelphia)	55	55¼
General Electric (New York)	168	170¼
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅞	1⅞
Massachusetts Electric common (Boston)	19	20½
Massachusetts Electric preferred (Boston)	*95	*95
National Carbon common (Chicago)	112½	104¾
National Carbon preferred (Chicago)	117¼	118
New England Telephone (Boston)	153	156
Philadelphia Electric (Philadelphia)	18	18⅝
Postal Telegraph and Cables common (New York)	82½	86
Postal Telegraph and Cables preferred (New York)	68⅝	68½
Western Union (New York)	83	84¼
Westinghouse common (New York)	75	76½
Westinghouse preferred (New York)	120½	116

*Last price quoted.

PERSONAL MENTION.

EDWARD REYNOLDS, auditor of the Postal Telegraph Company, has been made fifth vice-president.

E. J. RICHARDS, general superintendent of the Connecticut Power Company, has resigned his position on account of recent changes in the management of the property.

F. DOUGLAS WATSON, the general manager and secretary of the Constantinople Telephone Company, has just returned to Constantinople after a visit to England

D. F. McGEE, chief engineer of the Pacific Power & Light Company, has been elected vice-president of the Hanford Irrigation & Power Company, and will have charge of operation and construction.

O. T. PICKARD, who for the past eight years has been general manager of the Memphis office of the Cumberland Telephone & Telegraph Company, has been promoted to the office of district manager, with headquarters at McKenzie, Tenn.

EDWARD G. CONNETTE, who recently resigned as transportation engineer of the New York Public Service Commission, a position which he occupied for over two years, has accepted a position as vice-president of the International Traction Company of Buffalo.

CHARLES W. STONE, of the General Electric Company, made an address before the Washington Section of the American Institute of Electrical Engineers, Washington, D. C., on Thursday evening, May 2, on the subject of "Some Problems in Substation and Central Station Operation." Mr. Stone's talk was illustrated with lantern slides.

LEONARD A. JANSEN, who has been associated with the Milwaukee Electric Railway & Light Company since 1887, with the exception of three years when he served on the Board of Public Works, has resigned his position with that company to take a long contemplated vacation before entering a new field of activity. Mr. Jansen is known as the electrical pioneer of Milwaukee, having the distinction of erecting the first electric light plant, installing the first dynamo and stringing the wires for the first telephone to be used in Milwaukee. He also is well known in electrical fields in Racine, Oshkosh and Keokuk.

OBITUARY.

RICHARD J. CAREY, an electrical engineer in the employ of the New York Central Railroad, died on May 1, at the age of 30 years.

NEW PUBLICATIONS.

THE VACUUM DASHPOT.—Bulletin No. 1 of the Mechanical and Electrical Engineering Department of the University of Pennsylvania is entitled "An Analytical Study of the Action of the Vacuum Dashpot," by Karl Nibecker. It is a portion of a thesis presented for the degree of mechanical engineer.

TELEPHONE TROUBLES.—The fifteenth edition of "Telephone Troubles and How to Find Them," by W. H. Hyde has come from the press. The Cost Units which appear in previous editions have been omitted and there has been added a description of a phantom circuit and how to install it. The book is paper bound and contains 56 pages of material that will be helpful to telephone men working either the magneto or the common-battery system.

THE PENOBSCOT BASIN.—Water-Supply Paper 279, entitled "Water Resources of the Penobscot River Basin of Maine," has been issued by the United States Geological Survey. This paper contains the most complete information available concerning the general hydrographic features of the Penobscot basin, the rainfall, and the flow of streams, including floods and low waters. It also gives facts concerning the developed water powers and the industries using them and sets forth in some detail the locations and capacities of the undeveloped water-power privileges. The important water-power developments of the Penobscot basin, exclusive of numerous small gristmill and sawmill installations, aggregate a capacity of 66,190 horsepower.

NEW HOUSE ORGAN.—*The Fixtureman* is a new organ just being issued by The Tungstolier Company, of Conneaut, O. It is devoted chiefly to business hints for the electrical contractor who handles fixtures and the central-station man with a wiring and equipment department, as well as for the dealer who handles fixtures exclusively. The keynote of this little periodical is found in an announcement of recent Tungstolier publications, in which the ad-man says: "It is our idea that the trade wants co-operation rather than solicitation. The publications we issue are designed to help the fixture man sell goods, not simply to tell him where to buy goods." *The Fixtureman* is frankly patterned after the Philistine. Enough illustrations and items in lighter vein are scattered through its pages to hold the interest of the casual reader, while the sound business-building articles are of practical benefit and value to those more seriously inclined. While no subscription price is charged, the circulation is necessarily very closely restricted to those who are actively interested in the development of fixture business.

PROPOSALS.

JIB CRANE (ELECTRIC).—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until June 4 for one jib crane (electric) to be delivered at the Navy Yard, Brooklyn, N. Y., as per schedule 4546.

ELECTRICAL SUPPLIES. — Sealed proposals will be received at the office of the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until May 20 for furnishing electric cable, as per Canal Circular 707. Blanks and general information relating to this circular may be obtained from the office of the General Purchasing Officer, or from the offices of the various Assistant Purchasing Agents in the large cities.

LIGHTING SYSTEM.—Sealed proposals, in triplicate, will be received at the office of the Constructing Quartermaster, Seattle, Wash., until May 31, for the construction of an electric lighting system, furnishing and installing wire for buildings; also a pump with direct-connected motor, complete, at Ford Ward, Wash. Information, plans, specifications and proposal blanks will be furnished upon application to Captain J. R. Pourie, constructing quartermaster. A deposit of $5.00 will be required for the return of the plans.

ELECTRIC LIGHTING SYSTEM.—Sealed proposals, in triplicate, will be received at the office of the Constructing Quartermaster, Seattle, Wash., until May 31, for the construction of an electric lighting system and pump house with motor-driven pump, installing fixtures in buildings and for the delivery of certain electrical apparatus, all at Fort Casey, Wash. Information, plans, specifications and proposal blanks may be obtained upon application to Captain J. R. Pourie, constructing quartermaster. A deposit of $5.00 will be required for the return of the plans.

DATES AHEAD.

American Institute of Electrical Engineers, Schenectady, N. Y., May 17.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

Oklahoma Electric Light, Railway & Gas Association. Annual meeting, Oklahoma City, Okla., May 22-23.

Mississippi Electric Association. Fourth annual convention. Vicksburg, Miss., May 28-30.

American Society of Mechanical Engineers. Spring meeting, Cleveland, O., May 28-31.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Minnesota Electrical Contractors' Association. Annual convention, Duluth, Minn., June 16.

Canadian Electrical Association. Annual convention, Ottawa, Ont., June 19-21.

Michigan Section of the National Electric Light Association. Annual convention on board the *Majestic*, sailing from Port Huron, Mich., on June 21.

National District Heating Association. Annual convention, Detroit, Mich., June 25-27.

Society for the Promotion of Engineering Education. Annual meeting, Boston, Mass., June 26-29.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors Association. Annual meeting, Denver, Colo., July 16-19.

Ohio Electric Light Association. Annual convention, The Breakers, Cedar Point, O., July 17-19.

International Association of Municipal Electricians. Annual convention, Peoria, Ill., August 26-30.

International Association for Testing Materials. Sixth congress, New York City, September 3-7.

Association of Iron and Steel Electrical Engineers. Annual convention, Hotel Pfister, Milwaukee, Wis., September 16-21.

The 1912 Boston Electric Show, Mechanics Building, Boston, Mass., September 28-October 26.

American Electric Railway Association and its five affiliated associations. Annual convention, Chicago, Ill., October 7-11.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

With the Electrical Manufacturers

Ridgway Dynamo and Engine Company has moved its New York office to 39 West Thirty-second Street, New York City.

The Novelty Incandescent Lamp Company and the **Tipless Lamp Company** now have their main offices at Emporium, Pa.

The Central Service Corporation, 141 Broadway, New York, N. Y., has been organized by Kountze Brothers, bankers and financial agents, to deal in public-utility properties and other kindred enterprises. The company was incorporated March 15.

Queen & Company, Philadelphia, Pa., manufacturer of electrical instruments and scientific recording apparatus, has been adjudged an involuntary bankrupt, with liabilities in excess of $100,000. Richard S. Hunter has been named by the court as referee.

Delta-Star Electric Company, Chicago, Ill., is distributing a new pamphlet illustrating and describing the high-voltage Pittsburgh transformers which it is supplying for the new Chicago street-lighting plan. Data are given as to the temperature ratings, efficiencies, etc.

The Sterling Machine Company, Norwich, Conn., has issued bulletin No. 106, describing a double-system pump for use in connection with continuous oiling systems, which it is just placing on the market. The oil is drawn from the base of the engine, pumped to the filter and after filtering is pumped to an overhead reservoir. Gravity serves to feed the oil to the various bearings.

The Minerallac Electric Company, manufacturers of high-tension apparatus, compounds and specialties, and distributers for the Chicago Electric Meter Company, Chicago, has added to its list of manufactured products a complete line of varnishes, cloths, tapes, friction tape, and rubber-splicing compounds. This new material will also be sold under the trade name of "Minerallac."

Driver-Harris Wire Company, Harrison, N. J., has issued catalog J dealing with the numerous resistance materials which it manufactures. Much useful information of a general nature, as well as that pertaining to the special alloys manufactured by this company, are given. Wire tables for nichrome, advance, German silver, therlo and other special alloys, with price lists, are included.

The Electric Storage Battery Company, Philadelphia, Pa., has just closed a contract with the New York Edison Company for the installation of four additional Exide batteries. This contract is the largest ever made for storage batteries in central-station service, the capacity of these batteries at the emergency rate being 128,620 amperes, of which 48,140 amperes is for one battery alone. The New York Edison Company already had in use 45 batteries, which with this addition will have a combined one-hour rate of 158,330 amperes.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has established a western sales office and warerooms in the new Friend Building, 15 South Desplaines street, Chicago. The company will carry a complete stock of knife switches from 15 amperes to 5,000 amperes, plug cutouts, rosettes, baby knife switches, and other wiring devices corresponding to its complete catalog listings. These warerooms will take care of emergency shipments covering the entire western territory, and will be particularly available for handling the business of the Chicago jobbers. The company has

J. S. Jacobson.

had this project in mind for the past three years. The offices have been fitted in a very handsome and substantial manner, and the warerooms are arranged for the quick handling of mail, telephone, telegraph and counter sales. The office will be in charge of J. S. Jacobson, western sales manager of the company, whose efforts will be supplemented by a corps of salesmen both in the warerooms and on the road. Mr. Jacobson has been connected with the western office of the company for the past three years. He is one of the most genial and popular salesmen in the wiring-appliance field and has made a host of friends through the entire western territory.

The Terry Steam Turbine Company, 90 West Street, New York City, has recently put on the market several new types of turbines. One of these is the Terry three-bearing turbogenerator set made in sizes up to 25 kilowatts. Another is the type D turbine for pumps, blowers or generators, made in powers up to 600 horsepower and running up to 1,800 revolutions per minute. The third is the vertical type made in powers up to 125 horsepower. The smaller sizes, type ZVC, range in power up to 25 and 30 horsepower, and from there up to 125 horsepower the type BVC applies. This line is designed for driving pumps and centrifugal machinery.

Joseph Dixon Crucible Company, Jersey City, N. J., is distributing some special pamphlets dealing with different phases of lubrication. Lubrication is so important in all mechanical machinery that to neglect it or do it on a hit-and miss basis is liable to result in broken parts and shutdowns. Unless provision is made for the time when oil or grease fails to do its duty, serious abrasion is likely to take place. Ticonderoga flake graphite is claimed to be the only lubricant which will keep metal surfaces apart because of its affinity for them and its ability to knit up over them a covering which is tough, even and unctuous to the highest degree. When this graphite surface is produced it is surprising to note how much easier a piece of machinery runs.

The Westinghouse Machine Company, East Pittsburgh, Pa., has issued circular No. 506, entitled Westinghouse turbo-alternators. This is a valuable 40-page bulletin that briefly defines the principal types of steam turbines, shows how the Westinghouse-Parsons turbines embody the advantageous features of each, describes the various forms of these machines, and the details of their construction, method of governing, operation, etc. The generator construction is also described. Throughout the bulletin there are very many illustrations of the machine parts and of typical installations of these turbo-alternator sets, comprising plants of 300 to 100,000-kilowatt aggregate rating.

The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has issued bulletins dealing with standard mica condensers and with deflection potentiometers. The condensers are stated to be characterized by small absorption, small leakage, high insulation and low temperature coefficient. Such condensers can be obtained singly or in groups, permitting of various combinations. The Brooks deflection potentiometers are furnished in two models, one of which is for general purposes and one for photometric work. The two differ in the values of resistance and galvanometer constants. The model for photometric work is unsuited to the measurement of heavy currents. Model No. 3, for general purposes, has a range from 0 to 1.5 volts, which, by means of a volt box, is extended in various convenient ranges up to 300 volts. The accuracy of these instruments is stated to be quite high, which, combined with the speed and convenience of use, makes them very suitable for working standards in commercial and standardizing laboratories.

Record of Electrical Patents.

Issued by the United States Patent Office, April 30, 1912.

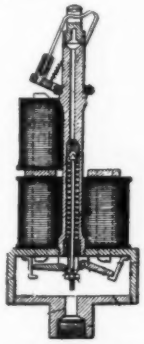
1,024,489. Wheel Brake C. Aalboro, assignor to Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Electromagnetic brake within a pulley or sheave.

1,024,495. Electric Lighting System. E. Booth and N. R. Booth, Halifax, England. Series incandescent system with shunt cutout for each lamp and an electromagnetically controlled shunt across entire circuit.

1,024,498. Telephone System. H. P. Clausen, assignor to Stromberg-Carlson Telephone Manufacturing Co., Rochester, N. Y. Relates to features of switchboard equipment.

1,024,533. Ozonizer. H. R. Stuart, and W. H. Thompson, assignors to Westinghouse Electric & Manufacturing Co. Has a set of tubular condensers that are successively connected across the secondary of a transformer.

1,024,538. Magnetic Separator. J. Weatherby, Jr., assignor to A. J. Dull,



1,025,047.—Electric Gas-Lighter.

Harrisburg, Pa. A rotary conical screen is located within the annular set of pole pieces.

1,024,539. Magnetic Ore Separator. J. Weatherby, assignor to A, J. Dull, Harrisburg, Pa. A modification of the above.

1,024,552. Electric Postmarking Machine. F. G. Boswell, Washington, D. C. Includes an electric two-part driver having a leader and a follower with a continually closed circuit between them.

1,024,555. Manufacture of Vacuum Lightning-Arresters. F. S. Chapman, assignor to National Electric Specialty Co., Toledo, O. The chamber is exhausted until the sparking between an external multiple air gap ceases.

1,024,557. System of Electric Motor Control. F. Conrad, assignor to Westinghouse Electric & Manufacturing Co. Railway motors are controlled automatically by relays that are governed by a master controller.

1,024,565. Constant-Temperature Bath. T. B. Freas, assignor to V. Weber & Co., Chicago, Ill. Has an electric heater with two thermostatic switches one responsive to room temperature and the other to that of bath.

1,024,572. Magnetizable Wedge for Dynamo-Electric Machines. R. E. Hellmund, assignor to Westinghouse Electric & Manufacturing Co. Iron-strip wedges for holding the coils in the slots.

1,024,573. Electric Illuminating Device. R. H. Henderson, assignor to Westinghouse Lamp Co. A method of mounting tubular lamps directly opposite each other on both sides of a shade.

1,024,577. Primary Battery. C. E. Hite, Burlington, N. J. A tank has partitions dividing it into separate cells, each having a carbon plate forming it into two compartments one containing the zinc plate and energizing solution and the other the depolarizer.

1,024,582. Door-Operating Mechanism. Sherman Jones, Newark, N. J. A sliding door is moved by an electric motor through a worm shaft.

1,024,587 and 1,024,588. Electric-Circuit-Controlling Apparatus. T. L. Lee, Jr., assignor to Hall Signal Co. A relay contact device for a signal circuit.

1,024,590. Selective signaling means. J. McFell, Chicago, Ill. Includes an electromagnetic step-up device.

1,024,597. Electrolytic Cell. O. H. Pieper and A. F. Pieper, Rochester, N. Y. The side chambers are smaller than the middle electrode chamber.

1,024,598. Separating Apparatus for Liquids. K. C. Randall and C. B. Gibson, assignors to Westinghouse Electric & Manufacturing Co. Provides means for withdrawing water from the bottom of transformer tanks.

1,024,601. Terminal-Attachment Engaging Device. J. E. Schaefer, Jr., assignor to American Ignition Co., Detroit, Mich. Terminal for a spark plug.

1,024,616. Machine for the Electromechanical Reproduction of Drawings, Writings, Photographs, Blocks, and the Like. H. Carbonnelle, Uccle, Belgium. Both the original and stylo records are moved so as to dip into nonconducting liquids.

1,024,621 and 1,024,622. Means for Exploding Charges. C. I. Dodson, assignor to Dodson Manufacturing Co., Phoenix, Ariz. A generator turned manually by a crank is short-circuited during its initial movement. A clock-controlled latch prevents operation except at the proper time.

1,024,631. Control System for Electric Motors. H. D. James, assignor to Westinghouse Electric & Manufacturing Co. Consists of four sets of resistance contacts in quadrants of a circle over which a cross-shaped contact moves reversibly to give speed control and dynamic braking.

1,024,635. Reversible Induction Motor. F. R. Kunkel, assignor to Westinghouse Electric & Manufacturing Co. A single-phase motor with two primary windings and centrifugal switch has a phase modifying device thrown into either primary winding according to direction of motion described.

1,024,657. Electric Furnace. E. Stassano, Turin, Italy. Is arranged to oscillate in a ring.

1,024,671. Socket Shell. T. A. C. Both, assignor to I. S. Rosenheim, New York, N. Y. Longitudinal screws on the shell engage ears on the cap to hold the shell and cap together.

1,024,709. Electric Automobile Clock. W. H. Thompson, assignor to Thompson Electric Clock Co., Memphis, Tenn. An electromagnet winds the spring.

1,024,710. Sparking Igniter. L. H. Wattles, Providence, R. I., assignor of one-half to M. C. Messler. The armature of the ignition generator is operated directly by the piston.

1,024,718 and 1,024,719. Electric Contact Device. C. W. Coleman, deceased, by K. Coleman, administratrix, assignor to Hall Signal Co. A contact closer for signal circuits.

1,024,732. Shade-Holder for Electric Bulb Sockets. C. W. Lucas, assignor to Faries Manufacturing Co., Decatur, Ill. A clamping ring grips

1,025,098.—Cable Hanger.

upwardly projecting fingers to the lamp socket.

1,024,769. Controller Regulator. C. P. Ebersole, assignor to American Automotoneer Co., Philadelphia, Pa. Includes ratchet teeth, cams, plunger, etc., to prevent a motorman from turning his controller too rapidly.

1,024,793. Means for Regulating Electric Circuits. H. Leitner, Woking, and R. N. Lucas, Byfleet, England. Regulates the lamp circuit in a system supplied through a generator and battery that is periodically charged.

1,024,807. Automatic Starting Device for Single-Phase Induction Motors. P. J. Ray, Lakewood, O. A centrifugal cutout device in which mercury is the active element.

1,024,809. Chandelier. A. Sechrist, assignor to Albert Sechrist Manufacturing Co., Denver, Colo. Relates to means for connecting and securing the tubular arms to the fixture body.

1,024,810. Mariner's Liquid Compass. L. A. Sherman, Pembroke, Mass. Has an incandescent lamp in the bowl to illuminate the reading surface.

1,024,819. Spark-Plug Holder and Spark Indicator. E. H. Benn, Wey-

mouth, Mass. Holds two plugs oppositely inclined.

1,024,834. Spark Plug. L. J. Dirand, Torrington, Conn., assignor of one-half to C. H. Carlin. Relates to details of construction.

1,024,853. Means for Operating Semaphores. W. K. Howe, assignor to General Railway Signal Co., Gates, N. Y. An electric motor moves the arm to set position.

1,024,857. Protective Device. A. G. Jones, assignor to General Electric Co. An electrolytic-cell lightning arrester with obstructions to prevent radial flow of electrolyte between the electrodes.

1,024,896. Electromagnetically Operated Switch. G. H. Hill, assignor to General Electric Co. A circuit-breaker with a loose connection between the toggle and plunger.

1,024,898. Filament Support. J. W. Howell, assignor to General Electric Co. Comprises a wire standard with a flattened end portion having the form of a tube and a resilient member held in the tube.

1,024,902. Switch Box. J. Kronberger, Coney Island, N. Y., assignor of one-half to L. Z. Schulhof. Has an angular opening in the top.

1,024,906. Apparatus for Working on the Upper or Wearing Portions of Compound Tram-Rails. J. Noll, assignor to Continuous Rail Co. Wilmington, Del. Motor-driven rotary tools are carried on a movable truck.

1,024,923. Process of Drying Cement Clamps for Filaments of Electric Lamps. H. W. Bresler, assignor to General Electric Co. A reducing gas is passed over the filament, an oxidizing gas is directed on the clamps and the combustion so formed is localized.

1,024,931. Meter Connection Box. F. C. Grady, Indianapolis, Ind. Within the box are binding-posts for the meter circuit.

1,024,935. Portable Fault-Finding Device for Electric Ignition Apparatus. S. P. Hedges, Greenport, N. Y. A pressure gauge to see whether the plug is tight.

1,024,936. Apparatus for Use in Reclaiming Vulcanized-Rubber Waste. C. S. Heller, assignor to Moore Architectural & Engineering Co., Akron, O. A reversible electric current is sent through the solution.

1,024,937. Process for Reclaiming Vulcanized-Rubber Waste. C. S. Heller, assignor to Moore Architectural & Engineering Co. Current is sent through in one direction and then in the reverse direction.

1,024,963. Alternating-Current Regulator. T. E. Adams, assignor to Adams-Bagnall Electric Co., Cleveland, O. A counterbalanced armature can swing to and from the stationary magnet poles.

1,024,964. Igniter. H. L. Allen, Okmulgee, Okla. An electric igniter for shooting gas or oil wells.

1,024,967. Electric Rat-Trap. J. Balint, Cincinnati, O. The rat must step on oppositely charged contact plates to reach the bait pedestal.

1,024,969. Electric Trap. C. A. Bowen, Riverview, Pa., assignor of one-half to F. Bickerton. In front of the bait holder is a charged gate and a charged bar.

1,024,970. Trolley Wheel. W. M. Boyer, Johnstown, Pa. Has a special running web held between the side rims.

1,024,972. Burglar-Alarm Attachment. A. Brewster, New York, N. Y. A circuit-closer.

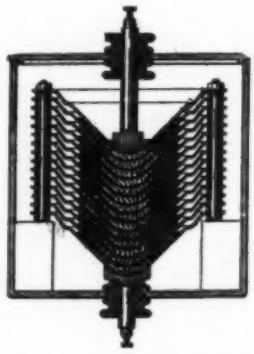
1,024,984 and 1,024,985. Controller for Electric Motors. J. R. Garner and M. R. H. Mueller, assignors to Electric & Ordinance Accessories Co., Ltd., Aston, England. A drum-type controller with no-voltage coil for the main switch and magnetic blow-out device to suppress arcing.

1,024,998. Electric Heating Element. J. C. C. MacDonogh, London, Eng. The coil is so held that its outer surface is continually exposed.

1025,003. Indicator for Railway Cars. A. May, New Orleans, La. Includes an electromagnet for operating a ratchet.

1,025,005. Electric-Lamp Fixture. A. G. McArdle, San Francisco, Cal. Construction of a globe-holder is described.

1,025,015. Occulting Device for Flashlights for Optical Telegraphy. E. L. P. Pailliard-Turenne, Paris, France. The shutters are operated by an electromagnet.



1,024,857.—Electrolytic Cell.

1,025,020. Electromagnet. A. Quastenberg, Erfurt, Germany. Has auxiliary poles formed of horseshoe bars.

1,025,021. Homopolar, Acyclic, or Unipolar Dynamo Electric Machine. O. Schulz, and W. H. Eyermann, Berlin, Germany. Oppositely rotating supporting disks carry conductor disks and collector rings.

1,025,026. Holder for Electric Lights, Telephones, and the Like. C. W. Sprague, Philadelphia, Pa. A canopy-like drop-cord adjuster.

1,025,047. Electric Gas-Lighting and Extinguishing Apparatus. J. S. Benton, assignor to Ideal Epworth Acetylene Co., Johnstown, Pa. Has three electromagnets, one for operating the valve, another for locking it, and the third for igniting the gas.

1,025,068. Fixture Hanger. J. G. Knight, Brooklyn, N. Y., assignor to N. P. Findley. Consists of a pair of angular supporting bars, fixture stem, outlet box and canopy.

1,025,079. Water and Sewage Lift. A. C. Wells, Amityville, N. Y. Includes an outlet and an inlet check valve, each being solenoid-controlled.

1,025,091. Safety Device for Passenger-Carrying Conveyances Propelled by Electricity. W. B. Hopkins, Denver, Colo., assignor to Schoolfield Safety Appliance Co. Includes a movable car step, pressure on which renders the main motor circuit inoperative.

1,025,098. Suspension for Cables. M. Morey, Milford, Mass. For supporting two superposed cables from a messenger strand.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 7, 1912:

538,648. Alternating-Current Motor. E. Arnold, Zurich, Switzerland.

538,649 and 538,650. Closed-Conduit Electric Railway. G. E. Baird, Chicago, Ill.

538,669. Safety Device for Electric Motors. R. Eickemeyer, Yonkers, N. Y.

538,670. Electric Transfer Switch. A. Ekstrom, Lynn, Mass.

538,686. Electric Time-Alarm Clock. M. Leibecke, St. Paul, Minn.

538,695. Electric Soldering Iron. W. H. Osborne, Prince's Bay, N. Y.

538,700. Electric Elevator. G. H. Reynolds, New York, N. Y.

538,744. Speed-Regulator for Electric Motors. F. B. Rae, Detroit, Mich.

538,758. Preventing Electrolysis of Street Pipes. R. Watkins, Sacramento, Cal.

538,764. Electrotherapeutic Apparatus. F. Borsodi Magyar-Banhegyes, Austria-Hungry.

538,773. Electric Tower Clock. J. H. Gerry and F. M. Schmidt, Brooklyn, N. Y.

538,777. Electric Watchman's Clock. O. E. Hausburg, New York, N. Y.

538,786. Electric Railway. H. R. MacLean and G. A. Kornetzke, Schenectady, N. Y.

538,816. Telegraph Sounder. J. H. Bunnell, New York, N. Y.

538,838. Supply System for Eelectric Railways. W. Lawrence, New York, N. Y.

538,871. Electrically Operated Switch. H. A. Hartman, Philadelphia, Pa.

538,919. Absorptive Material for Storage Batteries. E. E. Knowles, Brooklyn, N. Y.

538,971. Cautery Electrode. M. F. Laughlin, New York, N. Y.

538,975. Telephone System. J. W. McDonough, Chicago, Ill.

538,983. Interior Conduit. O. G. Traphagen and F. W. Fitzpatrick, Duluth, Minn.

538,999. Electric Arc Lamp. S. S. Allin, London, Eng.

539,017. Electrically Arranged Hose Coupling. W. Fowler, Colorado Springs, Colo.

539,019. Electric Lighting System. R. N. Chamberlain, New York, N. Y.

539,300. Electrical Hose-Signaling Apparatus. W. Fowler, Colorado Springs, Colo.